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▶ MINIMUM BS

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Microsoft gets **Interrogated** on the New Net

We Take Apart Apple's **iMac:** Whadda Lemon!

A **450MHz** Beast from Dell

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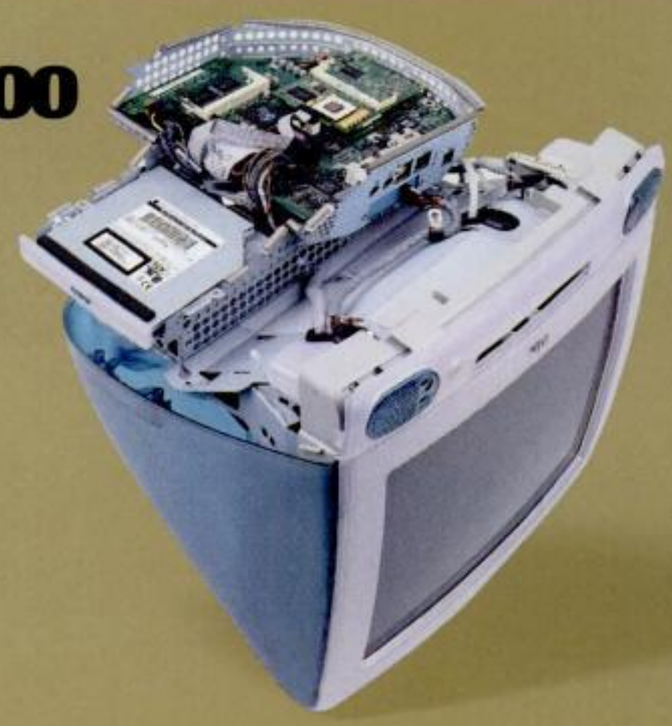
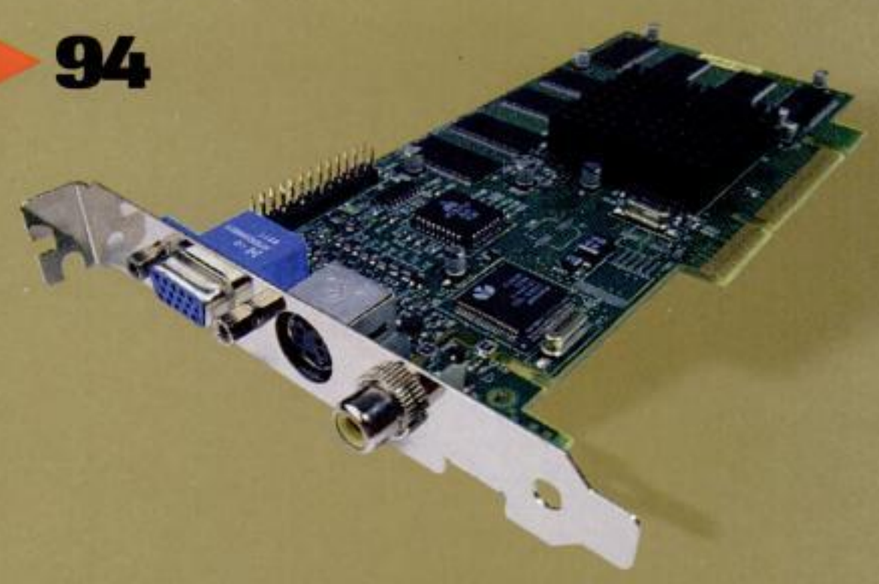
Dell's hot **450MHz screamer** packs nVidia's TNT for explosive performance and the Kick Ass award

▶ 100



We boldly take **Apple's iMac** where no mag has gone before and discover shocking alien thinking

▶ 94



nVidia's blazing **TNT chipset** blows away Voodoo² in our first review benchmarks

PLUS Everything You Ever Wanted To Know About Home Networks... But Were Afraid To Plug In

Faster...Faster...Faster...

1 Clocked at speeds over 60mph, the cheetah is the fastest land animal. This "big cat" hunts mainly gazelle, but the average chase lasts only about 20 seconds.

2 In early October 1998, *PC World* Magazine ranks the Micron Millennia the #1 Power Desktop on the market calling it "the fastest of all" systems tested.

INTRODUCING THE NEW FULLY LOADED 450MHz MICRON MILLENNIA

MICRON GOES TO WORK

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Micron Systems:
Over 100,000 deployed Micron desktops, notebooks & servers

Favorite Feature:
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Purpose:
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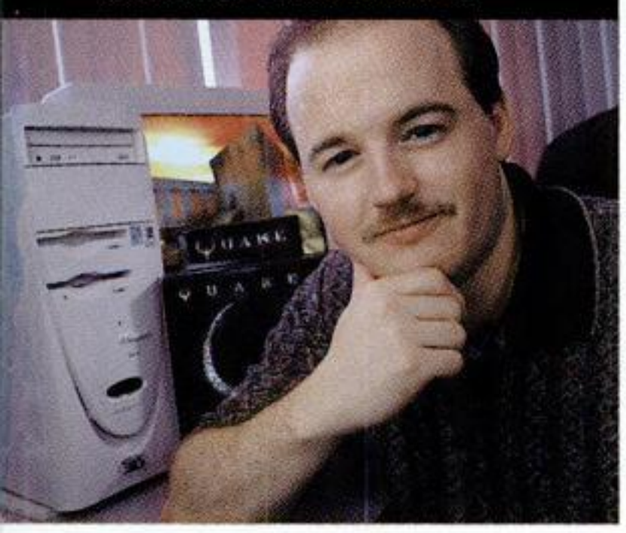
For The Whole Story: www.micronpc.com

Tim Willits
Lead Map Designer, id Software
Creators of Quake & Quake II



Micron Systems:
Micron Millennia 400 desktops

Favorite Feature:
400MHz - Of course

Purpose:
Test mind-bending levels of Quake II and help create one of the coolest games ever

For The Whole Story:
www.micronpc.com

Featuring Intel's Fastest Processor Ever

PCWEEK READERS RANK MICRON #1 IN DESKTOP CUSTOMER SATISFACTION‡‡

PC WORLD — Millennia 350 — Oct '98 — Sept '98

PC WORLD — Millennia 400 — Oct '98 — Sept '98

Just named #1 450MHz desktop by the editors of *CNET* and #1 Power Desktop by the editors of *PC World* Magazine (Millennia 400 DVD • October '98), Micron's Millennia desktop product line continues a long tradition of industry-leading, award-winning performance. Perhaps that's why some of the most prominent power users around rely on Micron. No matter how strenuous your demands, no matter how colossal the task, we invite you to put a Millennia® desktop to the test. You'll be hard-pressed to find a Pentium® II processor based system as powerful and affordable as the Micron™ Millennia. And Micron's revolutionary new MPower℠ purchase program makes Millennia ownership even easier, offering qualified users no interest◊ or payments for six months as well as PowerXchange℠ trade-in options on your current PC towards a new Millennia desktop.

MICRON'S EXCLUSIVE CONSUMER — 6 — NO PAYMENTS NO INTEREST — 6 MONTH SAME AS CASH OFFER

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A non-refundable up-front freight charge applies for participation in PowerXchange to cover cost of return packaging and processing.

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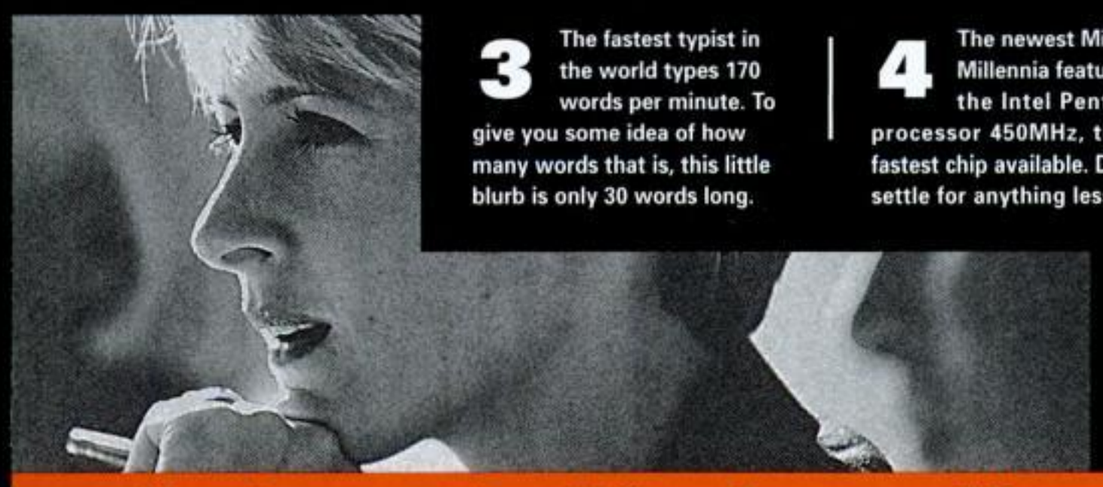

3 The fastest typist in the world types 170 words per minute. To give you some idea of how many words that is, this little blurb is only 30 words long.

4 The newest Micron Millennia features the Intel Pentium II processor 450MHz, the fastest chip available. Don't settle for anything less.

THERE IS NO KNOWLEDGE THAT IS NOT POWER.

— RALPH WALDO EMERSON

11
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98.11

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intel inside
pentium® II processor

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Cache	128KB internal L2 cache	512KB internal L2 cache	512KB internal L2 cache	512KB internal L2 cache	512KB internal L2 cache
RAM	32MB SDRAM	64MB 100MHz SDRAM	64MB 100MHz SDRAM	64MB 100MHz SDRAM	128MB 100MHz SDRAM
Hard Drive	4.3GB Ultra ATA hard drive*	10GB Ultra ATA hard drive*	10GB Ultra ATA hard drive*	10GB Ultra ATA hard drive*	14.4GB 7200 RPM Ultra ATA hard drive*
Monitor	15" Micron 500Vx monitor (13.8" display)	17" Micron 700Vx monitor (15.9" display)	17" Micron 700Vx monitor (15.9" display)	17" Micron 700Vx monitor (15.9" display)	19" Micron 900Lx monitor (18" display)
DVD/CD-ROM	32X max speed CD-ROM drive	32X max speed CD-ROM drive	32X max speed CD-ROM drive	32X max speed CD-ROM drive	DVD-ROM drive and decoder card***
Modem	3Com/U.S. Robotics 56K WinModem**	3Com/U.S. Robotics 56K WinModem**	3Com/U.S. Robotics 56K WinModem**	3Com/U.S. Robotics 56K WinModem**	3Com/U.S. Robotics 56K WinModem**
Graphics	nVidia Riva 128, 4MB SGRAM 3D AGP graphics	nVidia Riva 128, 8MB SGRAM 3D AGP graphics	nVidia Riva 128, 8MB SGRAM 3D AGP graphics	nVidia Riva 128, 8MB SGRAM 3D AGP graphics	Real 3D Starfighter i740, 8MB AGP graphics
Sound System	PCI 64-voice Wavetable sound	PCI 64-voice Wavetable sound	PCI 64-voice Wavetable sound	PCI 64-voice Wavetable sound	PCI 64-voice Wavetable sound
Warranty	5-year/3-year Micron Power℠ limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty
Software Included	Microsoft® Windows® 98 Microsoft Home Essentials Microsoft Power Pak Norton AntiVirus	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Norton AntiVirus	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Norton AntiVirus	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Norton AntiVirus	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Norton AntiVirus
Also Includes:	New MicroTower™ case Advent AV009 stereo speakers 104-key enhanced keyboard Microsoft IntelliMouse® 3.5" floppy drive	New MicroTower case Advent AV009 stereo speakers 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	New MicroTower case Advent AV009 stereo speakers 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	New MicroTower case Advent AV009 stereo speakers 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	Micron MiniTower case Monsoon MM1000 flat panel speakers 100MB Iomega Zip Drive 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive
Price	$1,199 $42/mo. TechRefresh Bus. Lease, 36 mos.**	$1,649 $58/mo. TechRefresh Bus. Lease, 36 mos.**	$1,749 $61/mo. TechRefresh Bus. Lease, 36 mos.**	$1,799 New Low Price! $63/mo. TechRefresh Bus. Lease, 36 mos.**	$2,899 New Low Price! $101/mo. TechRefresh Bus. Lease, 36 mos.**
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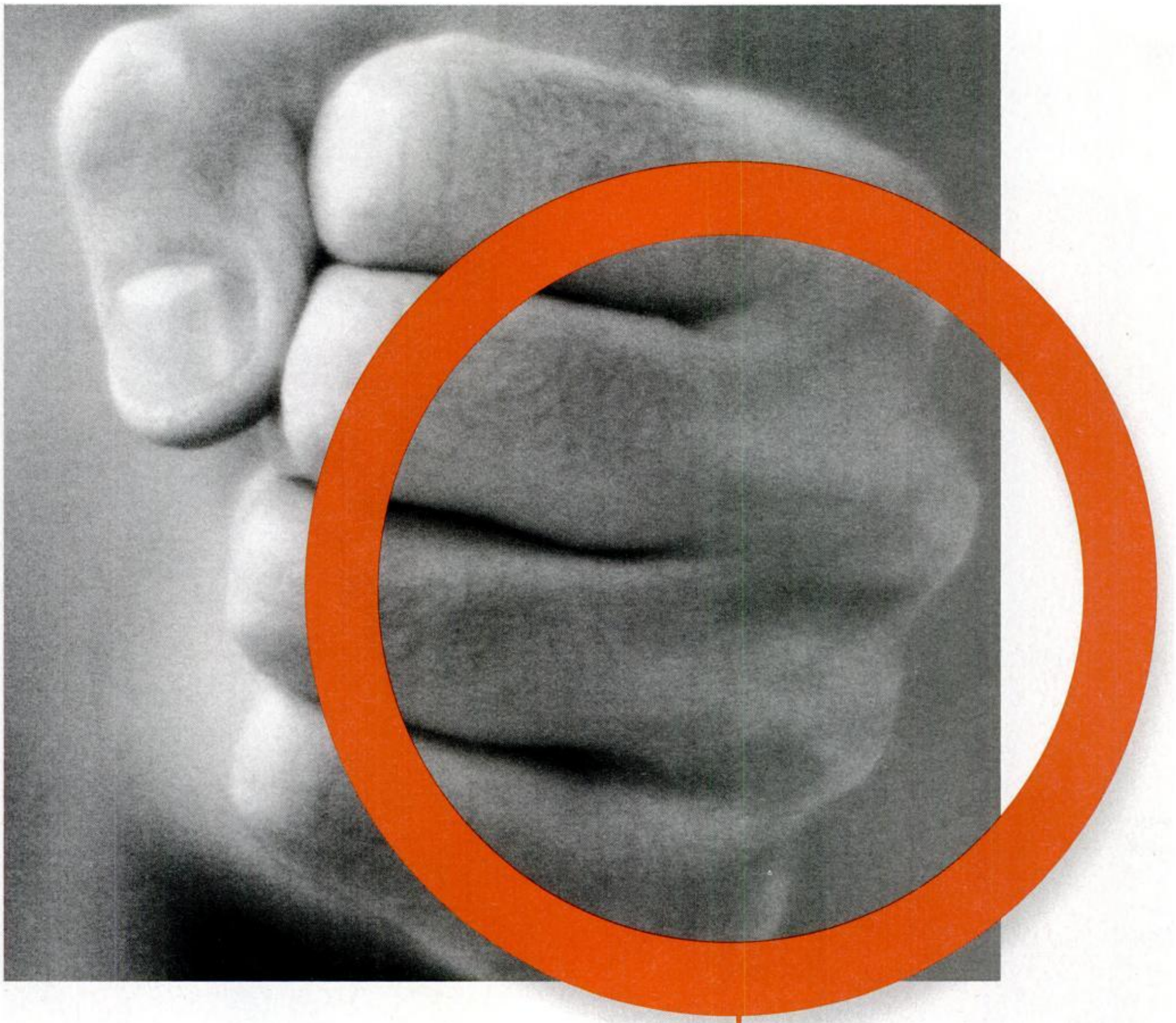

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and *chills* of
your favorite
games

and multiply by two.

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MAXIMUM PC

NOVEMBER 1998

56 Megapixelmania ▶

Digital cameras have come of age and megapixel resolutions are required to get into this party. But when the dancing's done, image quality determines which digital camera you want to go home with.

66 LAN Connection ▼

We put on our best Chuck Woolery hairdo to appease your PC's loneliness with a LAN connection. Everything you need to build a home LAN is here. We provide details on all the equipment you need, clue you in with important networking tips, and tell you how to put it all together.

46 Interrogation: Microsoft's Eric Engstrom ▶

Microsoft's figured out what's wrong with the Internet: It's too damn slow. And now Eric Engstrom's got the solution: Chromeffects, a set of extensions that make your browser—and your entire interface—multimedia savvy.

BONUS DISC 03

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Big Daddy believes free speech has a place in the information age.

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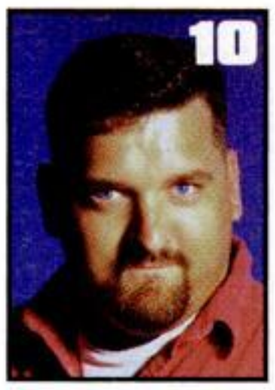

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Industry troublemaker **Alex St. John** talks about his early days in Hell. And no, we're not talking about Microsoft.

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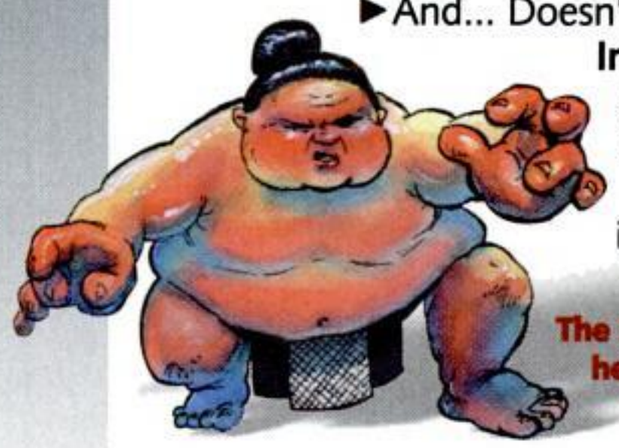
News you need to win the tech race.

▶**3D Sound** promises to be as hot this year as 3D graphics were last year, so of course there would have to be competing standards to muck matters up. We got the skinny.

▶And... Up to 85% of all hard drives sent in for repair aren't really broken, just confused. IBM's **new DFT technology** promises to clear matters up.

▶And... Doesn't the idea of paying **Internet taxes** sound great? Sorry, but states such as California are striking down this impending travesty.



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▶This month we take **Dell's 450MHz** system on a rowdy joy ride, explode a pair of volatile **TNT4-based videocards**, lock-pick the cutest lil' computer to drop from **Apple**, slit the throats of **Rainbow Six**'s rat-bastard terrorists, and build web shrines to Bill Bixby with **NetObjects Fusion 3.0**. And more!

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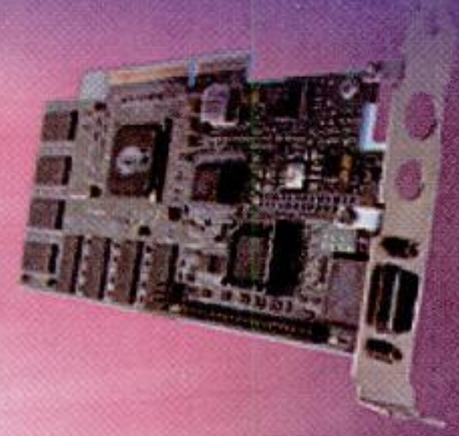

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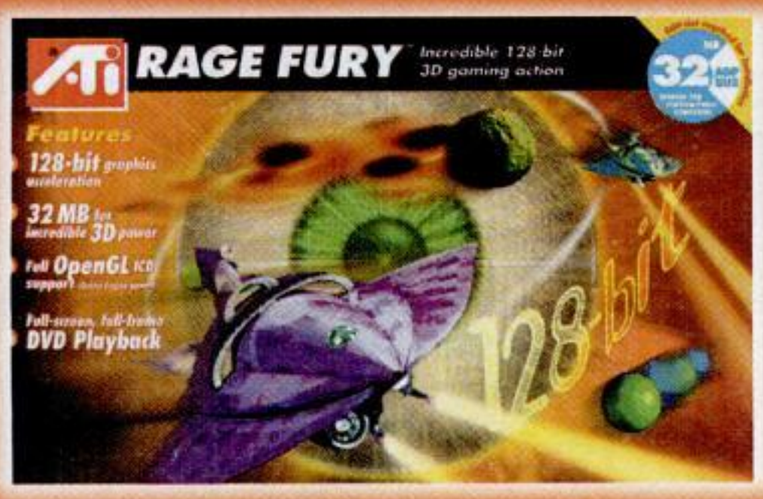

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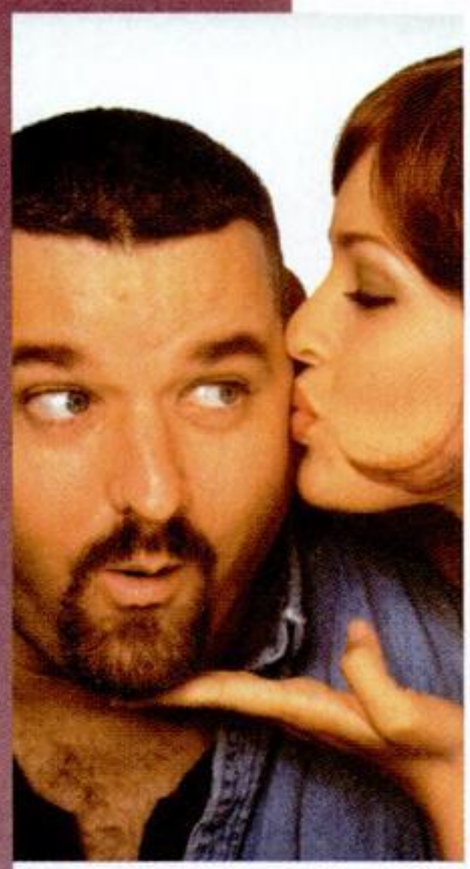
FROM THE EDITOR'S DESK

Idea Exchange



Since we're delivering maximum knowledge, I'm comfortable with the occasional opinion or joke.

A *Maximum PC* reader recently wrote in, *"I read the Dream Machine issue and noticed disturbing things. One was a very negative remark about Charlton Heston... What a jerk. The damn guy has all those stupid things like honor, honesty, and integrity. The other remark was about Bob Dole, you know, the fool that almost died in the war fighting to preserve our freedom."*

Another reader followed a similar comment with, *"Let's see you review* Tomb Raider *and say, 'Lara has the kind of gravity-defying jugs that must keep Bill Clinton up nights'. Probably not, huh?"*

Actually, we've had our fair share of presidential quips as well, including Game Theory columnist T. Liam McDonald's observation back in the third issue of our predecessor, *boot* magazine, "He's about as useful to his unit as Bill Clinton would have been to his." And Tom Halfhill makes reference to the President's favorite brunette in his column this very month.

The Lara Croft letter above came under the subject line: "Does the 'PC' stand for Political Correctness?"

Not at all. In fact, I believe just the opposite. We genuinely appreciate controversial opinions, even when they aren't directly related to our primary subject matter.

Whenever it provides, context, perspective, or even just a laugh, we won't hesitate to compare a subwoofer to a politician or a monitor to a supermodel or a 3D card to a religious figure. Nothing's sacred.

Upon reading a comment that disagrees with their opinion, readers are sometimes compelled to write in and remind us that we have no business talking about anything except PCs. In their mind, everything except cold hard specs and benchmarks are off limits.

If I felt that *Maximum PC* was somehow shortchanging readers when it comes to the inside scoop on Pure PC Power, I might agree. But since we're delivering maximum knowledge, I'm comfortable with the occasional opinion or joke in the magazine. In fact, I encourage it. It makes us all a little more human in an all-too-dehumanizing time.

Case in point, we received a double-barrel blast of criticism for Scott Wolf's anti-hunting comments in the *Deer Hunter* review in the premiere issue. Here's a sample:

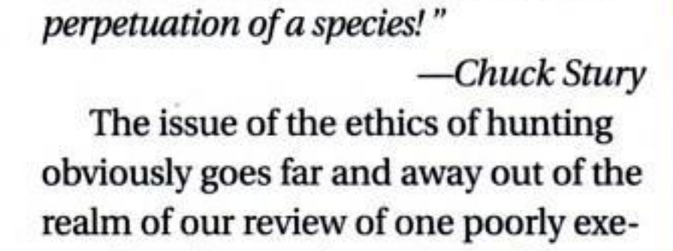
"I read every page from cover to cover thinking this might be a publication for my family, friends, and me. Everything was very nice indeed—until I read the review of Deer Hunter.

"If you have never experienced hunting, then you could not understand. The killing of a species is not what hunting is about. Justifying hunting for subsistence is nonsense. It is so much more than that. It is the hunt! It is relating to nature! It is understand and loving wildlife of all species! It is learning skills of survival! It is committing your resources to the survival and perpetuation of a species!"

—Chuck Stury

The issue of the ethics of hunting obviously goes far and away out of the realm of our review of one poorly executed game. But the reviewer felt compelled to share his opinion, and readers like Chuck felt compelled to share their contrary ideas. We'll print both sides of the story. Great!

What's the point of living in the information age if you don't explore new ideas and opinions, especially those that are different from your own?



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Editor in Chief

PHOTOGRAPHY BY JACK HUTCHESON

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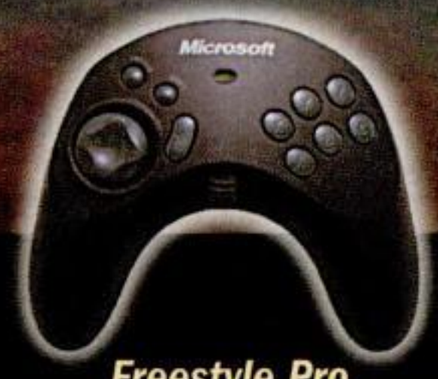

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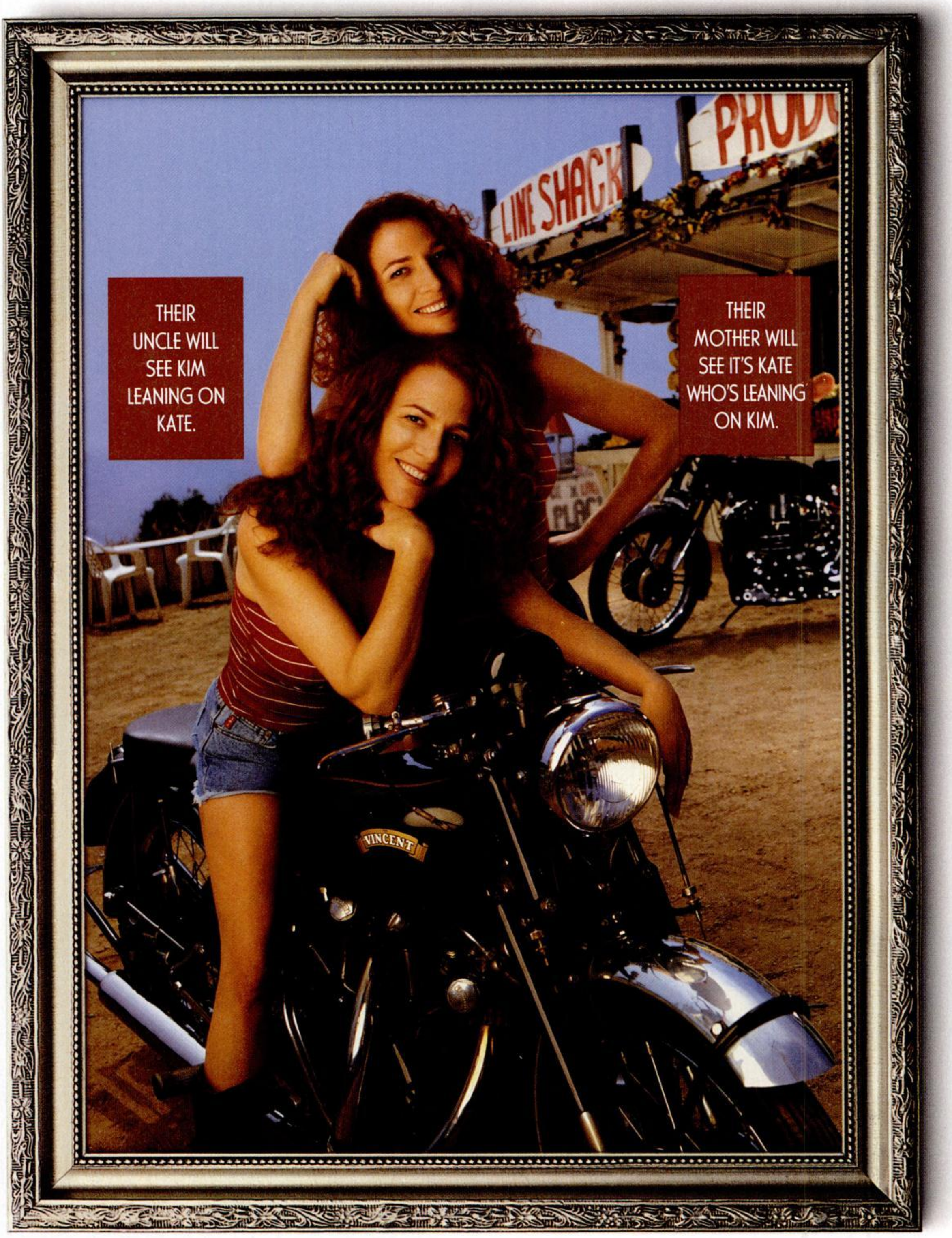

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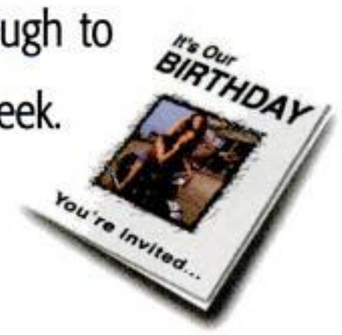

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COMM PORT

Letters from the Smartest Readers in the World

Here's the deal: You (being the smartest readers in the world) write letters about the magazine, the PC industry, the software you love or hate, and the hardware that runs it. We read it and share as much of it as space permits in the mag and online, and respond or comment when the letter calls for it. Get it? Now get busy and write us at **commport@maximumpcmag.com**

Beware the Anti-Heather

I just read the premiere issue of *Maximum PC*, and it does not in any way, shape, or form, reflect the values of *HomePC*. Who are these people trying to impress? Heather Walton needs to get a life! (Comm Port, September 1998) A lot of intelligent women, who have the respect of their male counterparts, enjoy computers, are very knowledgeable about them without using "techie" terms to impress men, but don't sit around daydreaming about the latest computer hardware.

—Kathy Marc

I am a Network Administrator and have never felt I had to write to any magazine. I came across the letter by Heather Walton and I just couldn't help myself.

You are not alone, Heather. I'm writing this from my laptop, as my wife and her girlfriends are presently involved in a *Quake II* deathmatch and refuse to relinquish a desktop machine. I know very few women who even know what *Quake* is, much less women who can hold their own in a deathmatch. The one I found I married. We spend a lot more time together than most couples I know because of this interest.

I'm sorry the men in your office feel this way, but please do not group all men together. Remember there are men who would love to talk with you on this subject. You wouldn't like it if we grouped all women together. I hate it when men are seen as a group of uncaring, uncooperative Neanderthals. I don't drag my knuckles and I'm always willing to listen to anyone's opinion, even if it disagrees with mine.

—Jack McDonald

"I know very few women who even know what Quake is, much less women who can hold their own in a deathmatch. The one I found I married."

Savage Criticism

Mr. Holdt's (CEO of S3, September 1998 Interrogation) logic about Savage 3D's visual-quality loss during compression is extremely flawed. Holdt says, "A typical texture size is 64x64, but we allow developers to go up to 256x256. In itself this gives you a higher image quality..." This is very misleading. What he seems to be saying is that currently most cards can handle 64x64 textures at an image quality equivalent to the Savage3D, but that's OK because if you want better image quality, just increase the texture size. The problem is when games that use really huge textures come out, the rest of the 3D card companies will have products that will run those games. So now everyone is running games with these 256x256 textures and saying, "Boy the image quality on my Savage3D board sucks." S3's response would be, "Well if the developers had used 512x512 textures, which our board can handle, the image quality would be better."

Game developers are never going to use bigger textures—which most consumers can't use—just so Savage3D-equipped gamers can degrade the image quality back to the level that the game designers were trying to overcome. Sheesh!

—Azag Black

Slow ECC at Play

I have a Pentium 333MHz computer with all the bells and whistles, which I use mostly for games. I have heard that ECC memory slows systems down. Is this correct?

—Karl Emmons

Technical Editor Sean Cleveland replies: Yes it is, but the performance hit is hardly noticeable, if at all. Error Correcting Code (ECC) does as its name implies—checks the memory for errors. By doing this, it creates overhead that affects the memory performance. This function can be disabled in most new BIOSes. Turning it off is a simple solution that also buys you peace of mind if you think your memory may be going bad. ECC memory was created for paranoid MIS types who pack a lot of memory into their servers.

Homogenized Drives

I am curious to know if you are aware of any technology or any in the future that will allow the home computer user to have just one DVD or CD drive that will fulfill all their needs—one drive that will record and play all formats of audio and video?

—Brian Sturm

Technical Editor Sean Cleveland replies: The drive that comes closest to realizing that dream is DVD-RAM. It plays all DVD-ROM discs and CDs including CD-ROM, CD-R, and CD-RW just fine. It plays DVD movies just as well and offers the ability

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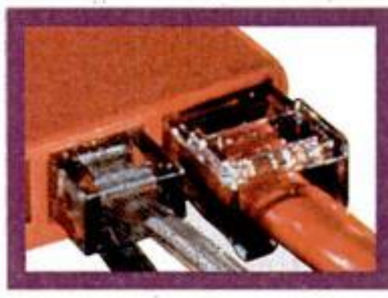
to rewrite to 2.6GB media. However, it records only to DVD-RAM media that cannot currently be read in any DVD-ROM drive, although the next generation drives promise to. We've heard that manufacturers can add CD-R and even CD-RW support to DVD-RAM or even the other DVD rewritable spec, DVD +RW, but it would require another costly laser. Rumblings in the industry hint that it might come to pass, but we haven't heard when or at what price. It is by far the most versatile drive so far and only needs to be paired with a decent CD-RW drive to fulfill your needs.



The high-speed modem technology relies on local telephone companies to maintain a digital signal with no analog-to-digital conversions, and as you are probably aware, this never happens.

I Want My Glitch PC

Hey! What the heck happened? I cracked open my new *Maximum PC* and flipped to the last page expecting the off-kilter and brilliant humor that I (and many other people) have come to know and love in *boot*'s Glitch column and... *gasp* ... it's not there! I frantically flip through the magazine, thinking perhaps you moved it to some other place. But no luck, it's gone. Please bring it back... PLEEEEEEEEAAAASE!

—Exiguus DeBartolo

Executive Editor Jon Phillips replies: Writing our resident humor column, Glitch, each month was an enervating experience that lowered my energy levels to the point where I was biologically indistinguishable from a sulphur moth. I have since re-energized, however, and I'm now ready to continue the Glitch tradition—if our readers demand the column's return. I now put Glitch's fate in the hands of the public: Do you want your Glitch PC? And under what condition? My fate is in your hands. Write the Big Daddy at **editor@maximumpcmag.com** and tell him how you feel.

Goin' ISPostal

I work for a national ISP providing free technical support to customers, and I have to tell you how sick I am of people complaining about not connecting at 56K, 21.6K, or whatever speed. I understand US Robotics has a "test" line located in the middle of the United States that customers can call (a long-distance call using the digital fiber optics of the long-distance phone company, typically AT&T), and they get the message that their lines are "X2 or V.90" compatible. This is the biggest sham. High-speed modem technology relies on the ability of the local telephone companies to maintain a digital signal with no analog-to-digital conversions on the way to the customer, and as you are probably aware, this never happens. I would appreciate it if you could snap your fingers and upgrade the old copper phone lines to digital and help me in filing a class-action

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lawsuit against the corporate scum who sell this "Magic 56K elixir."

One PO'ed Tech,
—Kyle Hunter

The Dark Side of USB

To Jason Hamilton ("Sell your Soundcard," September 1998): I wouldn't encourage anyone to jump on the USB bus. It may be good for scanners, digital cameras, and any other device that can't really saturate it. But I wouldn't get a USB digital speaker setup unless the USB bus could be accelerated. I recently tried the Philips DSS 370 USB digital speakers and found them to have excellent sound quality (much better than my soundcard and even better than the Cambridge SoundWorks setup).

However, there is a dark side. When playing games such as *Unreal* or *Flight Sim 98*, I get frequent sound glitches that weren't present using the old AWE64 Gold. After some investigation (the Philips speakers install USB bus-monitoring software that lets you look at bus timing utilization), it's clear the CPU is working hard to maintain the data stream running to the speakers. In the real world, this reduces game performance (lower framerates) 10% to 20%. Fortunately, it's easy to switch primary audio drivers from USB back to AWE64. The Philips USB speakers include a line-in jack, so it will take the line out from the AWE64. I must admit, when using the DSS 370s via USB, they sound so much better than the same WAV file being played via the AWE64 Gold .

It's clear USB is better than COM ports and will probably replace COM ports and printer ports, but it has a limited usage. Even Microsoft has suggested (quietly) that the USB bus isn't fast enough for its needs—i.e. the new USB Force Feedback Wheel still uses the old MIDI port on a good old soundcard.

—Rob R. Ainscough

Small Solders

I just read the HP Pavilion review and was less than pleased. I own the 300MHz Pavilion 8275 and I had no idea that you can't upgrade the graphics card because it's soldered to the motherboard. Is this true for my model as well as the 8290? Did I buy a bad computer? It works damn good, but I'm afraid I'll be out of luck in the not-so-distant future.

—Richard Felton

Senior Editor Andrew Sanchez replies: The easiest way to check whether your system has a soldered-down video solution is to look at where you plug in your monitor. Is the monitor I/O connector located where your serial and parallel ports are? If so, then yes, you've been soldered. To double-check, crack open your case and look at the motherboard for a black chip with white lettering saying "ATI Rage 3D."

With regard to upgrading your video solution, I'm afraid you are out of luck. Your only option is to throw in any add-in 3D accelerator, if that's what you want to upgrade. This will pump up your 3D gaming volume to new levels of greatness, but that's all they're good for. PowerVR and 3Dfx both make add-in boards that work with your current 2D videocard.

Ass Out

To save my ass, I can't find my copy of *Maximum PC* telling how to cancel my subscription at any time if not satisfied. I made a half-ass effort to find that information in the first issue under the new macho regime, but was unsuccessful and probably should have my ass kicked.

—Richard W. King

I had no idea that you can't upgrade the graphics card because it's soldered to the motherboard. Did I buy a bad computer?

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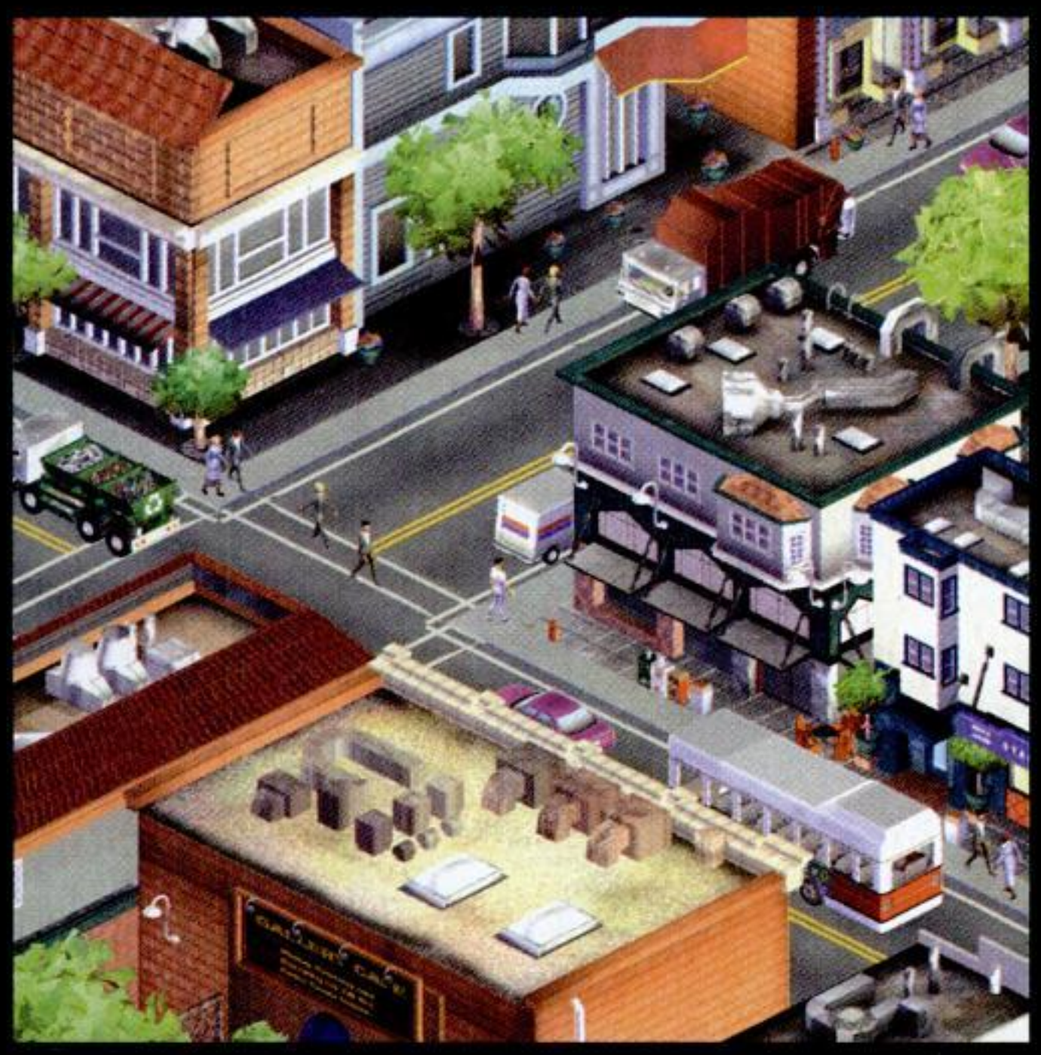

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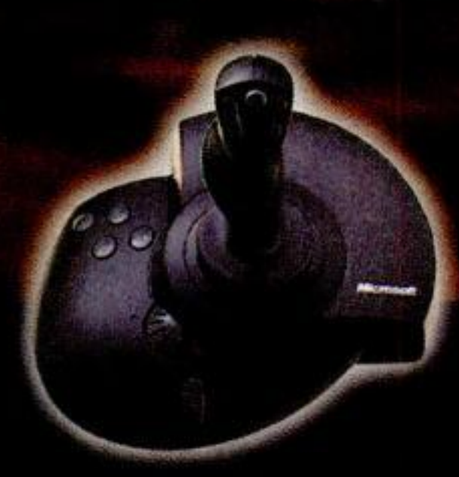
AS YOU CRUSH ROCKS WITH YOUR
MONSTER TIRES

...THE JOYSTICK SNAP WITH THE
IMPACT OF A ROCKET RIPPING
INTO YOUR TANK

...THE INTOXICATING POWER OF
BEING TOTALLY AND COMPLETELY
IMMERSED IN THE ACTION

Force Feedback Wheel



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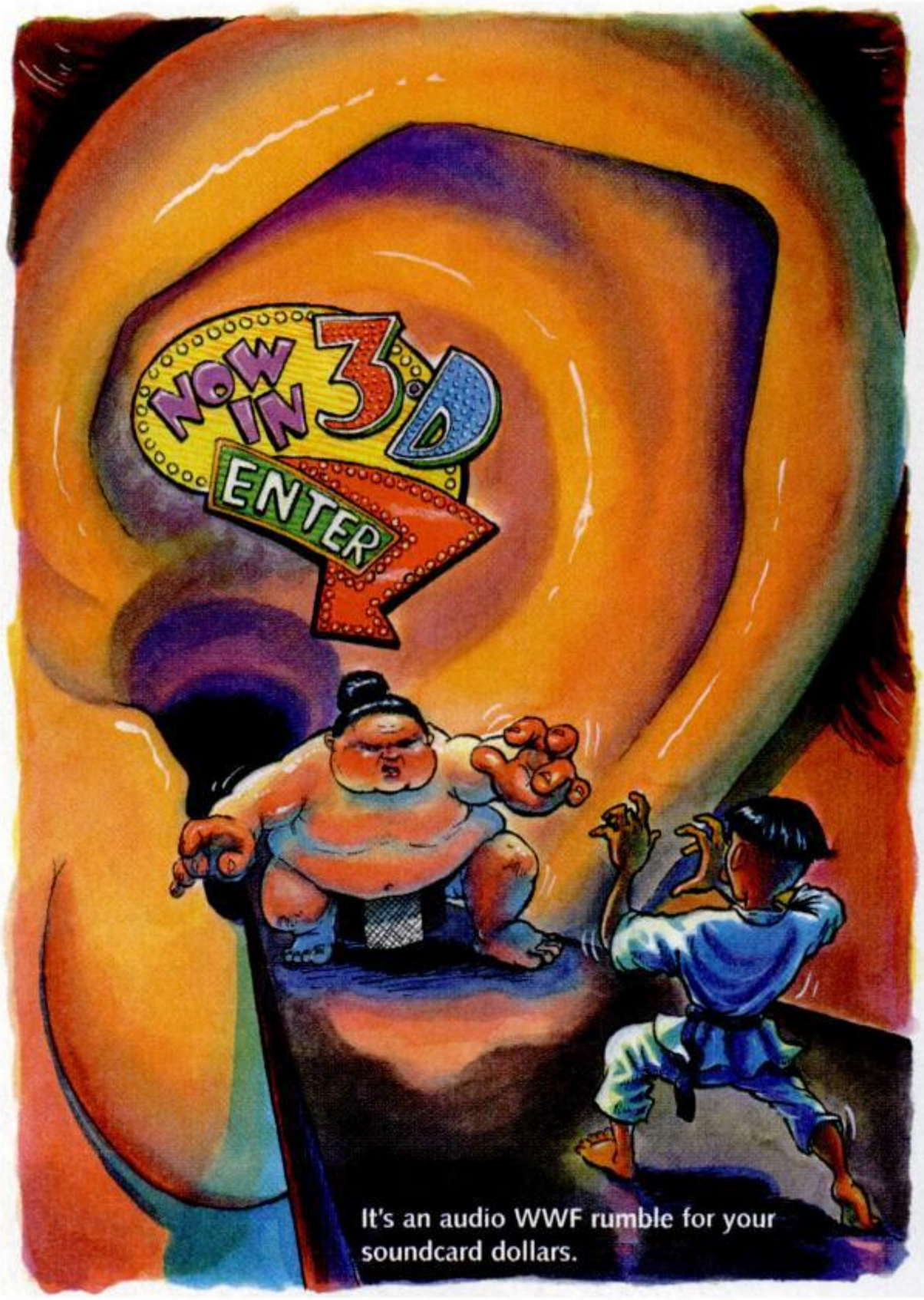
The 3D Sound War

Creative and Aureal Square Off



It's an audio WWF rumble for your soundcard dollars.

You barely scraped through the 3D accelerator wars with your bank account intact. And now a knock-down fight is heating up between audio companies Creative Labs and Aureal.

At stake for you is how you'll hear 3D sounds on your PC and which technology you plunk down money for in the coming months. At stake for them is the level of developer commitment, especially since support in hot software titles can translate into hot sales of soundcards come holiday season.

At first glance, Aureal's position seems sweet: its A3D 1.0 spec has already been integrated into a fair amount of titles, including LucasArts' *Jedi Knight*, and it appeared the company had power users already in its pocket. But when Aureal officially announced its new sound chip, the Vortex 2, and an ambitious sequel to its popular programming interface, A3D 2.0, Creative Labs hit back with its own Sound Blaster Live! PCI card (which received a perfect "10 Kick Ass" in the October 1998 issue) and a competing API extension called Environmental Audio (EAX).

"EAX is a tool for designing convincing interactive entertainment applications without imposing unnecessary effort on the game developer and the CPU," says Micah Stroud, Creative Labs' audio marketing manager. "The programming interface in EAX allows the game developer to directly concentrate on the perceived acoustical effects of reflections and reverberation." In other words, EAX allows developers to concentrate on the sound environments rather than the API itself.

But not everyone is impressed. "EAX is a very small and simple reverb extension API for DirectSound3D, and it only works on Creative hardware," shoots back Toni Schneider, Aureal's vice president of audio. "In comparison, A3D is a very complete, stand-alone API that runs seamlessly on any Windows audio subsystem, taking full advantage of all standard 2D and 3D audio capabilities."

When asked to comment on the merits of each other's technologies, both Creative Labs and Aureal lay it on thick. They call each other's solutions either too simple or too complex, and label each other's APIs proprietary or closed. And both are quick to suggest that developers adopted their competitor's technology because they were paid money to do so, and not because of the underlying technology—a practice that, according to Creative's Stroud, is necessary to seed early development support.

ILLUSTRATION BY SCOTT PECK

SPIN CYCLE

This month's top stories broken down ▶

HEADLINE	NEWS	DETAILS	QUOTE	OUR SPIN
Diamond Introduces Portable MP3 Player	Diamond extends its umbrella into the mobile audio realm with its Rio Portable Media Player, a credit-card-sized device that lets you listen to MP3 files anywhere.	The $199 Rio is armed with 32MB of flash memory and can hold up to 60 minutes of digital-quality music. It weighs a paltry 2.4 ounces.	"The proliferation of music on the Internet and Diamond's expertise makes the Rio a natural progression," says David Watkins, VP and GM of Diamond Multimedia.	MP3s are the best way to listen to music on the PC. So, anything that makes it easy to take it on the road gets a "thumbs-up" from us.
The World's Smallest Hard Drive Unveiled	IBM has unveiled a 340MB hard drive that weighs less than a single AA battery, and has a disk platter no bigger than a large coin. It'll be available in mid-1999.	The Microdrive is geared toward portable devices, such as PDAs and digital cameras, and is compatible with the current PC card and CompactFlash Type II slots.	"Our Microdrive technology will stimulate the invention of new devices that take advantage of its high capacity and high performance," says Bill Healy, IBM general manager.	With Canon and other companies already pledging support for the new technology, Microdrive looks destined to become a hit, especially for digital cameras.

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"EAX improves upon the technology base of the Creative family, but unfortunately it is too little, too late."

—Mark Dochtermann, CTO, Ritual Entertainment

"This is a common practice in the technology sector," Stroud admits. "But each new generation of hardware needs a 'kick start.' Aureal has done the same thing with A3D 1.0, and we hear, with A3D 2.0."

By making EAX an open extension to Microsoft's DirectSound interface, Creative appears poised to be successful in building industry consensus and has even managed to convince ESS Technology and QSound to board the EAX wagon. Creative also hopes Microsoft will add EAX to future versions of DirectX. This open-ended approach may make it easier to entice developers who may have been wary of Creative's past proprietary practices.

"Electronic Arts is very selective when it comes to technologies we include in our games," says Don Mattrick, president of EA's worldwide studios. "But Environmental Audio is the clear winner."

Each camp has its own legion of fans. "EAX technology improves upon the technology base of the Creative family of cards, but unfortunately it is too little, too late," said Mark Dochtermann, chief technology officer at Ritual Entertainment. "While Creative has been developing technology that is more on par with *Doom*, Aureal has been creating future technology more applicable to today's games such as *Unreal* and *SiN*."

Dochtermann says A3D 2.0 allows game developers to create more natural, ultra-realistic acoustics. "EAX is definitely better than what we have right now," he said, "but in the future I would rather be working with A3D's occlusion, reflection, and doppler shift than EAX's big-room, small-room, and cavern options."

Far from content to fight the battle only on the technology front, the two companies are now at the litigation stage. Creative Labs has filed suit against Aureal, alleging patent infringement, and is seeking an injunction that would halt the shipment of Aureal's older Vortex chips and its next-generation Vortex 2. Aureal, as expected, maintains the suit is without merit and says a circling of wagons by Creative is a sign of how much the larger companies fear its lead in garnering developer support and mindshare from the trade press and gamers.

But according to Mercury Research, Creative, ESS Technology, and Cirrus Logic still hold the lion's share with more than 60% of the market. However, Aureal recently teamed up with the dynamic duo of Diamond Multimedia and Turtle Beach to push Vortex 2–based cards exclusively in the United States.

Although the situation seems headed for a standoff, the resolution may not be so dramatic. Aureal has indicated it may support EAX in its new API, and some developers have expressed interest in supporting multiple 3D sound APIs. Even the übergame *Unreal*, which both Creative and Aureal cite as a sign of developer support, uses both technologies.

"The use of a particular API is not exclusive," says QSound's Scott Willing, who claims most developers want to keep the audio scales balanced. "For example, a developer could support DirectSound3D and EAX (directly or via another third-party API), and also support A3D 2.0, in one title. The situation is not as black and white as many people think."

Regardless of who wins the war, one thing is certain: The upcoming year will be a great one for 3D audio. Let's just hope consumers don't get caught in the proverbial crossfire.

3D Sound Head to Head

Aureal's A3D 2.0

A3D 2.0 incorporates wave tracing, an audio cousin to ray-tracing and occlusion. Sounds are carefully traced and reflected in a 3D-modeled "audio" world. Occlusion will also help create the illusion of noisy objects behind walls.

Pros A more precise and hopefully more realistic rendering of 3D sound. Move behind a wall and the volume will dampen down.

Cons Wave tracing dozens of sounds may be too complex for some developers to tackle and could prove to be host-CPU-intensive without the right hardware.

Creative Lab's EAX

EAX adds reverberation, echo, and other effects to enhance the sound realism. An example of this is in distance cues. Creative maintains that reducing volume, as a way to simulate distance, isn't as realistic as tweaking reverberation and echo. Distant sounds can be loud too.

Pros Sound is often a development afterthought. By making it easy to add 3D sounds and reverberation effects, Creative expects developers to embrace its simplicity. Effects can also be used on older games.

Cons Doesn't currently support occlusion. First-generation API may not offer enough precision for shifting effects.

to the pertinent details.

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HEADLINE	NEWS	DETAILS	QUOTE	OUR SPIN
Intel To Offer Socket-Based Celeron Processors	Starting in early 1999, Intel will offer 300MHz and 333MHz Celeron processors using the older pin-based design.	Intel's switch back to the older design may reflect growing resentment from vendors claiming Slot 1 is too expensive to implement in low-cost PCs.	"Offering the Celeron in a new pin package is part of our strategy to lower the overall cost of the Basic PC platform," says Intel's Seth Walker.	Sockets? Slots? Geez! Can't Intel make up its mind on which interface it wants to push?
Computer Sales On The Rise	According to IDC, worldwide computer sales grew 11% for Q2 1998, with Compaq leading the pack at 2.8 million units shipped.	The biggest winner was Dell, which experienced a whopping 70% gain over the previous year. Packard Bell/NEC was the biggest loser, posting an 8.7% reduction.	"We expect the market to perform better in the next six months," said Bruce Stephen, IDC group VP of worldwide PC research.	Compaq's bloated inventory levels incited price cuts across the entire industry.

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technology ▶ hard drive diagnostics

IBM Introduces Hard Drive Fitness Test

New technology will help deflect consumer returns

If you've ever been victim of a hard drive failure (and who hasn't encountered that sickening feeling at least once?), you'll be happy to know that IBM is doing something about it. No, they haven't found a way to resuscitate your important data, but they have developed a Drive Fitness Test (DFT) that should enable you to diagnose your hard drive, *without* shipping it back for repair.

According to Michael Mitoma, IBM's program director of hard drive customer satisfaction, approximately 3% to 5% of all hard drives shipped to consumers are returned for warranty repair. But the majority of these drives aren't actually busted. "Of all the drives returned to OEMs, about 60% to 85% of them are determined to be NDF, or No Defect Found," Mitoma says. "That means the drive is operating properly, but was returned for a different problem that was believed to be a hard drive defect, but was in fact not."

Virus-infected files, an erased directory or key file(s), or an inability to boot the OS inevitably force users to contact technical support for help.

"Of all the drives returned to OEMs, about 60% to 85% of them are determined to be NDF, or No Defect Found."

—Michael Mitoma, Program Director hard drive customer satisfaction, IBM

But since OEMs and system manufacturers are hampered in their ability to solve the problem, due to the low level of technical information that can be gleaned over the phone, these types of calls usually result in the hard drive being returned for repair. And if that happens, both sides lose out—the consumer mourns the loss of data that is almost always not recovered, while the OEMs mourn the loss of a profit every time a drive has to be replaced.

To overcome this, DFT-enabled drives will include a bootable DOS partition that can be accessed even when the drive itself is damaged. This "secret compartment," essentially a diagnostic partition, cannot be accessed by any part of an operating system and is free from viruses, erasures, or mistakes. This logical volume will contain the core DFT test programs and microcode, and other diagnostic software (or OSes) that OEMs could use to determine the specifics and severity of the problem.

OEMs currently supporting DFT include Acer, Dell, Hewlett-Packard, and IBM's own ThinkPad division. Other drive manufacturers—including Seagate and Maxtor—have also been approached, but most are taking a "wait and see approach" before committing. To that end, IBM is working with the ATA standards committee to include DFT, or some derivative, in the upcoming ATA-5 specification.

IBM hopes to have DFT fully implemented in its own drives by the end of the year. At press time, IBM had no plans to charge for the technology.

IBM's Drive Fitness Test may help reduce consumer returns and tech support calls.

ILLUSTRATION BY SHERRY MONARKO

SPIN CYCLE

◀ 26 ▶

HEADLINE	NEWS	DETAILS	QUOTE	OUR SPIN
Symantec Forced To Recall Product	After a preliminary hearing, the U.S. Federal Court in San Jose ordered Symantec to stop shipping and recall from distributors its Norton Uninstall Deluxe.	Cybermedia has alleged that Norton Uninstall Deluxe contained code copied from its Uninstaller. The copyright-violation trial is expected to start later this year.	"We do not believe Norton Uninstall Deluxe ever contained code copied from Cybermedia's product," says Enrique Salem, VP, Symantec's Security and Assistance Unit.	The legal mumbo jumbo makes our head spin.
Microwave PC Heats Up The Kitchen	Taking cues from Dr. Frankenstein, cash-register giant NCR plans to produce a combo microwave oven, TV, PC, and bar-code reader.	The "Microwave Bank" is attracting interest from Barclay's Bank and other institutions that hope to offer online banking through it.	"At NCR we believe in adapting technology to the consumer rather than the other way around," said Stephen Emmot, director of NCR's Knowledge Lab.	It's convergence gone mad. What's next, a waffle maker, flatbed scanner, and laser printer? Hmm... not a bad idea.

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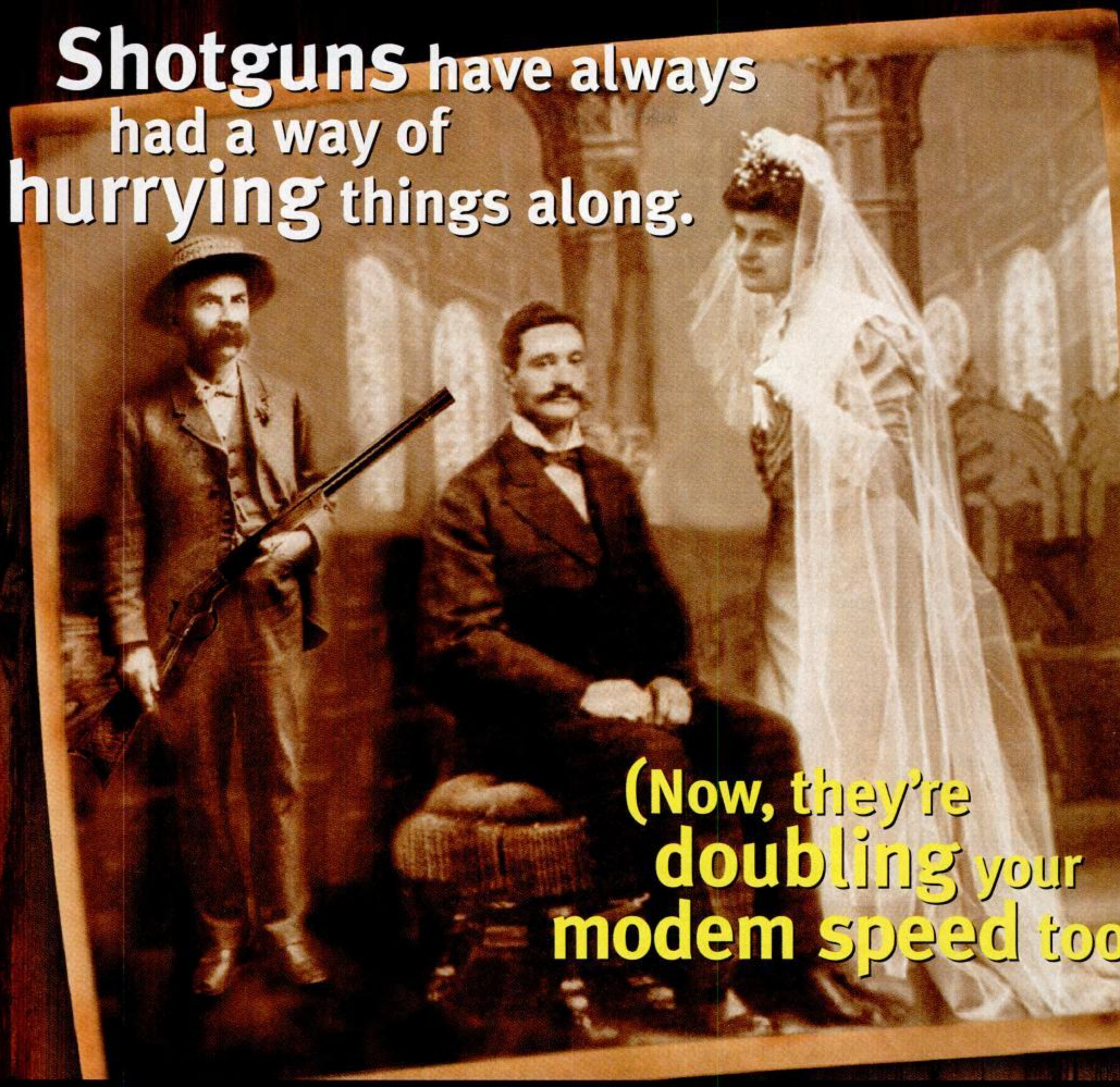

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California Says No To Internet Taxes

Other state, federal legislation pending

Internet users can rest easy—with their pocketbooks intact—now that California Governor Pete Wilson has given his stamp of approval on a new law that prohibits local governments from levying new taxes on Internet businesses and e-commerce.

"Taxing the Internet should be banned completely."
—Ted Lempert, California Assemblyman

The bill, dubbed the California Internet Tax Freedom Act, officially takes effect January 1, 1999, and ensures California-based Internet businesses won't be subjected to the tax whimsies of local governments who view the growing Internet as a way to expand their coffers. It was approved by the California state Senate by a vote of 32 to 1.

"Taxing the Internet should be banned completely," said California Assemblyman Ted Lempert, one of the bill co-sponsors. "The Internet is still in its infancy stage, and having a tax could stunt its growth." Although Lempert favors an outright ban, a three-year moratorium (which will likely be extended) had to be included to placate the fierce competition from local governments, who Lempert says "were just philosophically opposed to another level of government telling them they couldn't tax someone."

So what does this mean for you? For one, you won't have to pay taxes on your ISP service (numerous cities, including San Bernardino, have attempted this). And any purchases you make online—regardless of where you live—won't be charged California sales tax.

"Having a web site located in California does not create a nexus for the purpose of taxation," said Lempert. "We view Internet commerce the same way we view mail-order sales: companies will pay a usage tax back to the state (as dictated by current law), but the average consumer will pay nothing at all."

As a result of the California bill, other states—including New York and Utah—now have similar legislation pending.

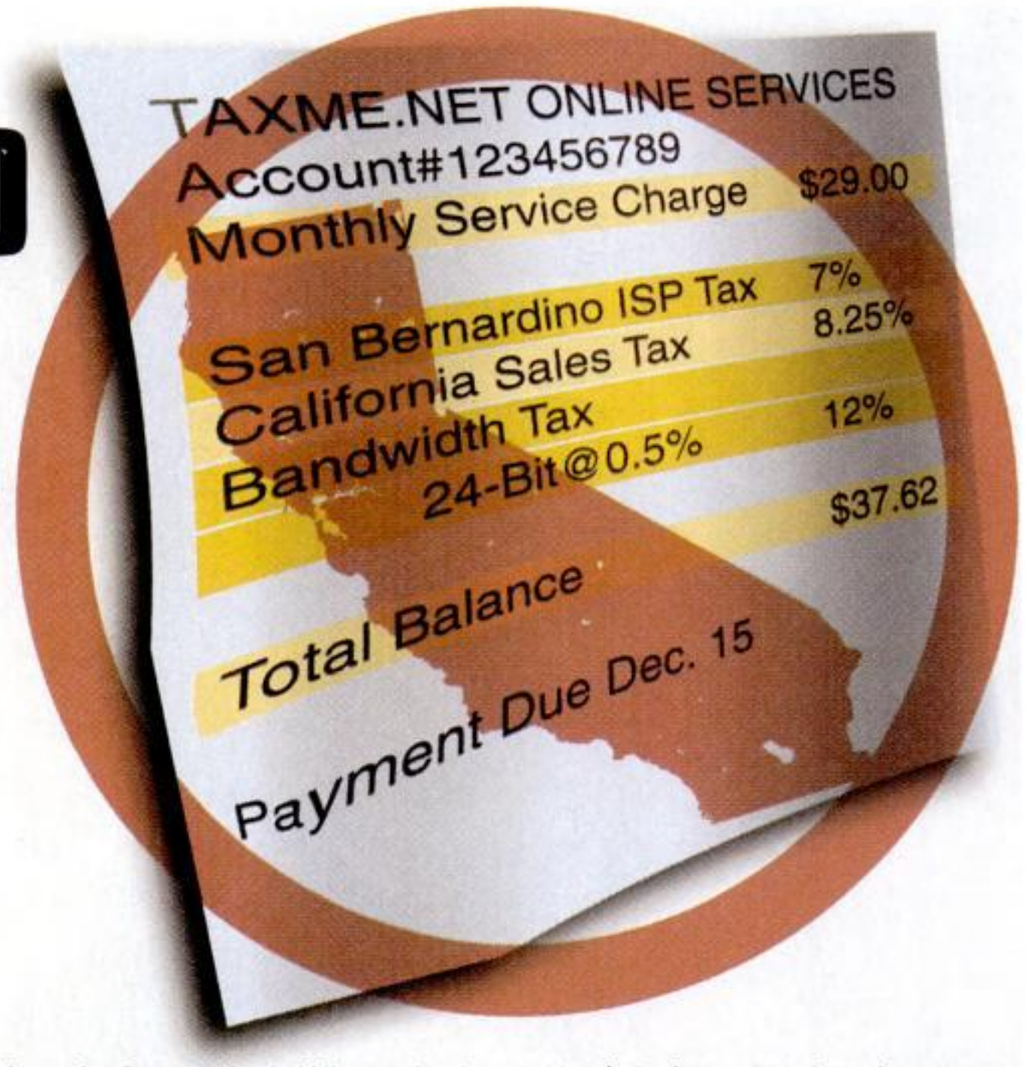
"Many technology-driven states—such as Massachusetts, North Carolina, and New York—are not happy that California has a virtual lock on this 'New Economy,' " said San Francisco-based tax attorney Richard A. Saffir. "It would be stupid for them to eye short-term Internet tax revenues, but risk losing a much larger economic driver, namely increased jobs."

The bill also bans the dreaded "bit tax," or "bandwidth tax," measuring the amount of data that is electronically transferred to and from your account. In theory, users would be assessed surcharges based on the size of the files, or the time it takes to download the data.

"The definition of 'bit tax' is far too broad, " says Saffir, "and would provide a competitive advantage to users with faster pipelines into their homes."

A federal initiative—endorsed by President Clinton, and also named the Internet Tax Freedom Act—is now before the Congress. Before the bill becomes federal law, however, the U.S. Senate must reconcile a number of issues. Among the hot topics: a controversial "grandfather" clause—which would provide a moratorium exception to eight states that presently tax Internet access—and the actual length of the moratorium. The House favors three years; the Senate favors six.

Regardless, the Senate's approval is expected before the end of the year. ✹



Users in Connecticut, Wisconsin, Iowa, North Dakota, South Dakota, New Mexico, Tennessee, Ohio, Texas, and South Carolina, are already paying Internet taxes. New laws will prohibit other states from following suit.

ILLUSTRATION BY SHERRY MONARKO

SPIN CYCLE

HEADLINE	NEWS	DETAILS	QUOTE	OUR SPIN
Big Three Push New Bus Spec	Industry heavy hitters IBM, HP, and Compaq are proposing a new PCI-X specification to increase the speed of servers.	The backward-compatible PCI-X spec will double or quadruple the PCI bus to 133MHz to handle gigabit Ethernet, Fibre Channel, and Ultra 3 SCSI.	"PCI-X clearly drives industry-standard computing to the next level," said Mary McDowell, Compaq's vice president and general manager.	While it sounds good, without Intel's-which created the PCI spec-support, the coalition of competing partners could create another EISA fiasco.
New Single Chip Offers Modem and DSL Support	Virata says it can now make a single chip that supports both analog 56K modems and Digital Subscriber Line (DSL).	Dubbed "Beryllium," the chip hits download speeds of 1.5Mbps. Beryllium will also support 10BaseT network support.	"This chip means manufacturers can now offer high-speed, fully featured modems suitable with either existing or new computers," said Charles Cotton, Virata's CEO.	While DSL is hardly ubiquitous or affordable, anything that helps push communications companies to offer faster access for consumers is always a good thing.

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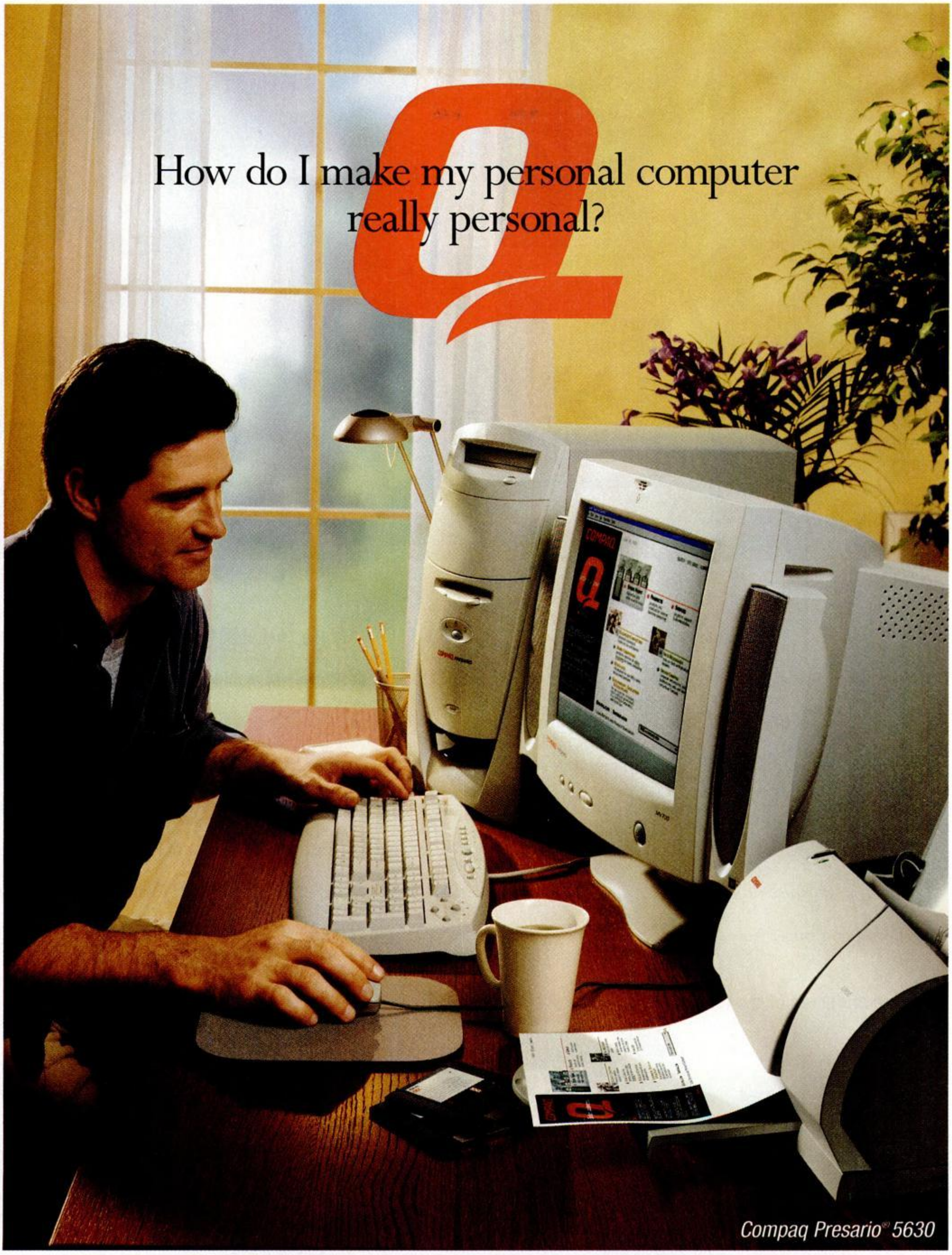

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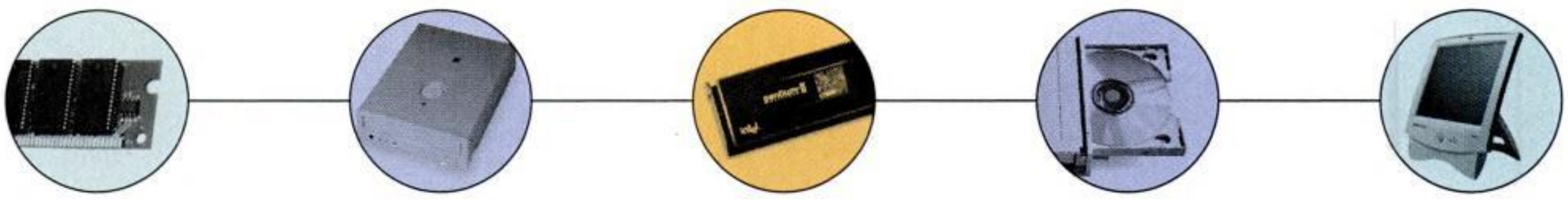

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WATCHDOG

▶ Maximum PC takes a bite out of bad service and gear.

Watchdog will take a bite out of those vendors who sell products that don't live up to their spec-sheet claims, those who don't honor warranty periods, and those whose customer-service personnel need to be re-taught the definition of "service." If you have a problem with a vendor that you just can't get resolved, write to us. We'll hunt down offending vendors—and trust us, our bite is worse than our bark.

K6-2 WOES ▶

DEAR DOG Before I begin, let me make one thing clear: I do not like Intel.

I have an FIC VA 503+ board. I'm also running a Monster Sound and a Creative 24x CD-ROM drive. I've had my 300MHz K6-2 for more than three months. I've always been a fan of AMD. I think that it'll soon pass Intel as the Giant of Processors. At least I hope. But after AMD's weak attempt to perfect the 3DNow! processor, I have my doubts.

I was a big gamer, until I installed the **K6-2** processor. Very few of my games will run. I'm a certified AMD reseller, so I contacted them, but they told me that they haven't experienced similar problems and to wait for DirectX 6. Guess what? That didn't work.

So I switched the chip and motherboard with a friend, and installed his 233MHz Pentium on my board, and bam! Everything worked without a hitch. I even installed the Monster Sound that I could never get to work with the K6-2, and it worked beautifully!

I then put my board and processor in his machine and it went nuts. Nothing worked. Then I switched out my motherboard. Still no luck. So I called AMD again, but they gave me the runaround and told me that it was the software, not the hardware. After installing the new software, there was still no change. I have more than 500 games, and believe me I tried them all. In fact, the total number that ran correctly was 71. Besides games, the K6-2 works great. Except that my old 233MHz K6 (with a 66MHz bus vs. 100MHz bus) ran Windows faster.

Now I am looking to upgrade my processor again. I was looking at the 333MHz K6-2, but now there is no way after this. I guess I will jump on the Pentium II bandwagon (which makes my stomach turn). As much as I regret doing it, I'm forced to. I've never seen a problem with the "Giant of the Industry" (Intel) running games. As much as I hate to say it, it's "Bye-bye AMD. It was nice knowing you."

—Dan Creviston

THE DOG We contacted Jerry Isaac, AMD's K6 Technical Marketing Manager to find out if Dan's problems were in fact related to the K6-2, or something else entirely. Here's what Jerry found out.

"I had given Dan a call to see if we could diagnose his problems remotely over the phone, but when we didn't have any success doing that, I suggested he send his complete system to us, at our expense. He didn't describe very well in his e-mail what the symptoms were. But it turns out that when he would run games relying on his CD-ROM drive, he was getting various error messages, such as 'a certain file on the CD was not found,' or the game wouldn't recognize the CD-ROM drive at all. He also mentioned that his Monster Sound wasn't producing any sound.

"After receiving his system, the first thing we did was to check his CD-ROM settings under the Windows Control Panel. We noticed that the DMA box was checked. Knowing that running DMA mode on CD-ROM drives can cause some problems on certain systems, we unchecked it. We're not sure why it was turned on in the first place, but it might have something to do with the installation of his bus master drivers for his VIA MVP3 chipset that he has on his motherboard. We rebooted the system, and ran *Quake* and *Incoming*, and everything seemed to work fine.

"We noticed that the DMA box was checked. Knowing that running DMA mode on CD-ROM drives can cause some problems, we unchecked it."

"There were a couple of things wrong with his Monster Sound card. First, the Monster Sound drivers for Windows 98 hadn't been installed. We downloaded the new drivers, and installed them, but that in and of itself didn't seem to solve the problem. It turns out that there is an Interrupt driver on VIA's web site that is required for Windows 98. Apparently there is an issue with the Windows 98 default miniport driver that routes the PCI interrupts. We downloaded and installed this new driver and once it was installed, the soundcard worked fine.

"We called Dan after we shipped the system back to him, and he told us that some of his games still won't recognize the CD-ROM. We tried a few of those games on our systems here, but couldn't recreate any problems. He told us that he would experiment with a few things and try a new CD-ROM drive. However, we're not 100% certain why the CD-ROM drive doesn't work."

Shortly after, Dan contacted THE DOG for a final say.

I received my system back yesterday, and no dice. AMD was very helpful, but I still cannot play all of my games. Sure, more of my games work now, but most of them do not. They paid for shipping of my computer and I know that was quite expensive; however, the problems are still here.

I can only conclude that the problem still lies with the K6-2. I plan to build a Pentium II machine and go nuts with

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it. All these games worked on other machines, and they all worked before I upgraded to the K6-2.

The bottom line is that I am done with AMD.

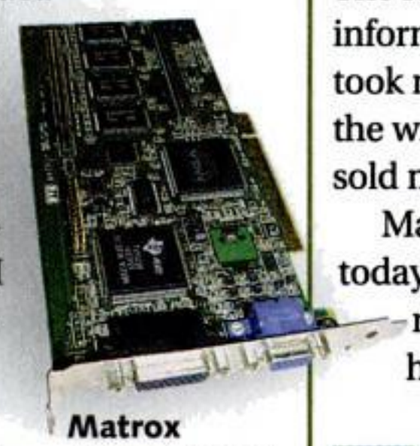
THE DOG isn't 100% convinced the K6-2 was to solely to blame, but can understand Dan's disappointment. When you're cheerleading for a vendor, it hurts when things don't work perfectly. The Dog also tips the dog dish to AMD for going to such lengths to try to satisfy Dan.

RAMDAC WOES ▶

Reader Ivan Labrador was confused about the Matrox Millennium II videocard he bought, so he wrote to Matrox and forwarded the letter on to THE DOG:

"The Matrox representative took my word that I may have received the wrong board in the wrong packaging. Matrox is sending me a new 250MHz board via UPS today."

In January, I decided to build a new computer and base it on the Millennium II because it always came up on top in specs in the magazines. I read about the Millennium II that had WRAM and a 250MHz RAMDAC. Your average person has no idea what a RAMDAC is, but the general consensus is that the higher the number, the better. I went down to London Drugs, purchased a 4MB Millennium II PCI, and had my local computer guru install it.



Matrox Millennium II

Then I began reading the manuals and discovered my card had a 220MHz RAMDAC. I recall the box saying the card had a 250MHZ RAMDAC speed, so I researched a few magazines again, and found in bold letters "get your Millennium II with a screaming 250MHz RAMDAC." I went to my retailer and said I had been sold the wrong board. They politely said they couldn't accept an exchange because too much time had passed and that I should contact the manufacturer.

I contacted tech support and learned two different cards were made, one with a 220MHz and the other with a 250MHz RAMDAC. I asked if it was possible to exchange the card, but never heard from tech support again.

To a consumer expecting the best, this was really disappointing.

—Ivan Labrador

THE DOG contacted Matrox Graphics' Public Relations Specialist, Debbie Hynes, for clarification. Hynes said she checked the film used to produce packaging for the 220MHz and 250MHz versions of the card, and it doesn't appear there was a mix up. Hynes continues:

"There certainly was a period last year when you may have purchased a 220MHz product and also saw advertising for 250MHz versions of Millennium II PCI. At the time, Matrox Graphics was transitioning between increasing the RAMDAC speed and worked to ensure there would be a smooth transition to the faster RAMDAC for consumers and within retail.

"When Matrox Graphics launched the Millennium II in June 1997, it shipped with a 220MHz RAMDAC. All packaging at the time of production stated 220MHz RAMDAC, as did all advertising. However, as Matrox Graphics is dedicated to delivering the highest-performance products at the most effective prices, we were able to introduce a new Millennium II with a 250MHz RAMDAC. In October 1997, Matrox moved to a 250MHz version of the Millennium II. All packaging and advertising coincided with the ramp up.

"Possibly, in January 1998, when you purchased the product from a retailer, this product was 220MHz. Although Matrox Graphics was already advertising its new 250MHz product, the 220MHz product may not have been flushed through retail. In other words, it is possible that you purchased an item from an 'older' version of the product at the retailer, while there was a 'newer' version being produced and advertised.

"I trust that this clarifies any confusion that may have occurred."

THE DOG contacted Labrador for a final word on Matrox.

The response from Matrox was excellent. After gathering information about my board, the Matrox representative took my word that I may have received the wrong board in the wrong packaging or that the retailer London Drugs sold me old stock.

Matrox is sending me a new 250MHz board via UPS today. I would really like to thank Debbie Hynes. She is the reason I will continue to buy Matrox products and has made a loyal customer out of me.

THERE'S SOMETHING ABOUT DEADLOCK ▶

I misplaced my *Deadlock: Planetary Conquest* CD. Yeah, I know it's an old game, but it's still one of my all-time favorites. Anyway, I've searched high and low but can't find it. All the software stores I thought might carry it say it's been discontinued for a long time. So, I thought I'd ask around on the net. Do you know of any online mail-order software site that might have it (I'm only 15 and don't have a credit card), or is there anyone on the *Maximum PC* staff who needs someone to take it off their hands?

—Charlie "ZERO" Wagoner

Ooohh... THE DOG can relate. Especially since we like to throw CDs around the backyard and catch 'em in our mouth. After all, they're just like Frisbees, only smaller.

In any case, once the folks at Accolade heard about your distress, they promptly mailed us a full copy of the game, box and all. We've forwarded it over to ZERO, who we presume is once again busy conquering planets and aliens. A special WOOF and doggy treat goes out to Jack Symon, Accolade's PR Specialist who handled this request.

Got a bone to pick with a vendor? Spiked by a fly-by-night operation? Sic the dog on them by writing: watchdog@maximumpcmag.com. The dog promises to get to as many as possible but only has four paws to work with.

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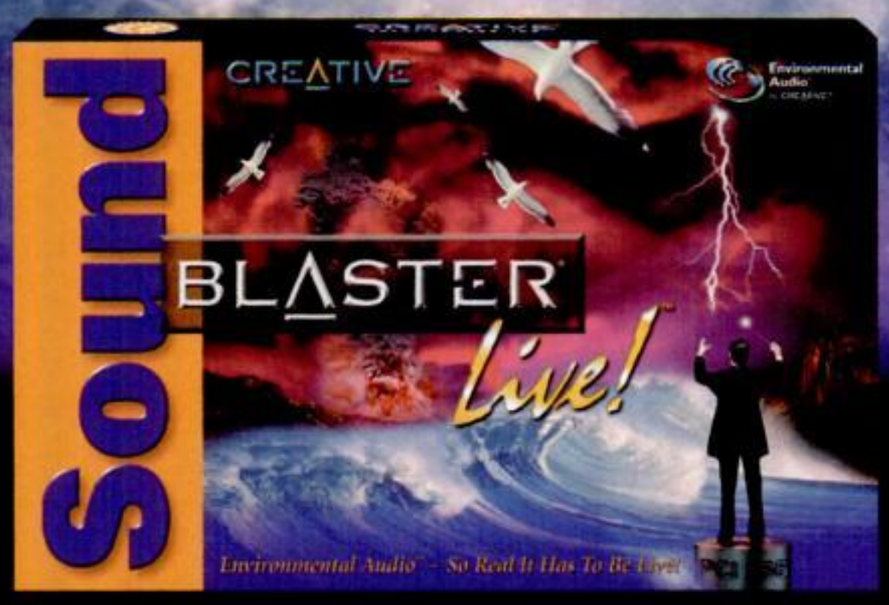

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Environmental Audio™ by CREATIVE®

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- **Environmental Audio Software Technologies** created by E-mu Systems®, Inc., a subsidiary of Creative, that provides high-end audio equipment to Hollywood studios, will change the way you perceive audio forever. They include:

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  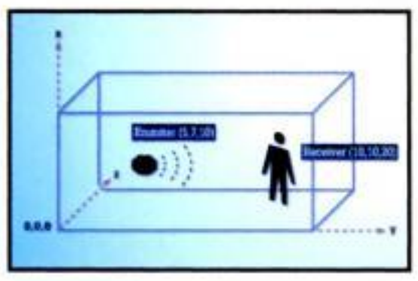

  Creative Multi Speaker Surround™, which allows real-time panning and mixing of multiple sound sources using two or more speakers. These technologies will greatly enhance audio content from the past, the present, and the future.
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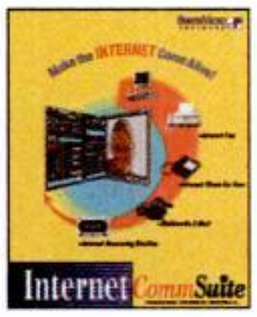

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Act Labs; 800.980.9997; www.actlab.com

◀ ExpressBus

USB—and an assortment of USB peripherals including printers, game controllers, and modems—is finally here. Yet most PCs include only two USB ports. So what's an early adopter to do? Enter the ExpressBus, a four-port hub that lets you add and remove USB devices without rebooting your PC. The $90 ExpressBus provides one upstream port and four downstream ports, and supports both full-speed (12Mbps) and low-speed (1.5Mbps) devices. The ExpressBus can be configured to draw power from the host PC, but if you're using multiple hubs or power-hungry USB devices, an external power supply is also included.

Belkin Components; 800.223.5546; www.belkin.com

◀ Quicktionary

When it comes time to read those retro paper documents, do you miss all the spellcheck, dictionary, and thesaurus tools in your favorite word processor? Seiko Instruments puts the word power of The American Heritage Dictionary into a pen-based Quicktionary that optically scans the printed word at 300dpi and then uses OCR technology to provide a complete definition on the 122x32 pixel LCD screen. The $250 pocketable device packs over 400,000 words, is under six inches long, and weighs in at around 4 ounces.

Seiko Instruments; 800.344.5555; www.seiko-usa-cpd.com/cpd/quicktionary.htm

Sony KL-W9000 ▶

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Sony; 800.352.7669; www.sel.sony.com

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FAST FORWARD

TOM HALFHILL
was senior editor at Byte magazine and is regarded as one of the most knowledgeable experts on processor technology in the industry. Contact him at **thalfhill@maximumpcmag.com**

Overcoming Serverphobia

KEEPING YOUR VALUABLE DATA LOCAL IS LIKE SAVING MONEY IN A MATTRESS

You break out in a cold sweat. Your palms start itching. Your heartbeat overclocks to 300MHz, and your blood pressure surges like a T1 line from a web site that claims to have nude photos of Monica Lewinsky. Are you in the throes of drug withdrawal? Has someone threatened to take away your PC? No. You're afraid of servers.

Countless PC users are afflicted with serverphobia. They don't trust servers to store their data. They abhor the throwback to centralized computing that servers seem to represent. They think their data is safer when cuddled in the loving arms of their very own PC. So they rage against anything that would move local data to remote servers.

Serverphobia became epidemic a couple of years ago when companies such as Sun, IBM, and Oracle announced network computers (NCs)—simplified machines that would store programs and data on servers instead of on local hard drives. Immediately, a herd of pundits and industry rivals denounced NCs as "dumb terminals" and claimed the whole thing was a devious plot to overthrow PCs and restore mainframes to their former glory. Of course, an NC isn't a dumb terminal and a server isn't necessarily a mainframe, but the critics were counting on their listeners not knowing that.

Put aside your opinion of NCs and consider the argument against storing data on a server. Critics say, "What happens if the server crashes and the network goes down? You could lose your data. What happens if somebody snoops on the network? Somebody could steal your data." The crux of this argument is that computing is more reliable and safer when it's local.

That's like arguing it's safer to keep your life savings under your mattress than in a bank. Sure, banks can fail; people lost money that way in the Great Depression. But nobody in the United States or any other stable nation has lost their savings that way since the 1930s. If you think your money is safer under a mattress, it means you think a total economic collapse is more likely than a fire, flood, hurricane, tornado, earthquake, or burglary.

If your data is as valuable as your money—and for a business, it's the same thing—you need to store it just as safely. Backups are almost worthless if they're in the same location as the data. When I'm working in an office, I save my unfinished work on a floppy and bring it home each night. I feel even safer when I store my files on a server. The server closet is usually a secure room in another part of the building, providing some protection against local damage and theft. More importantly, the servers are tended by professionals who regularly back up the data on tape, which is stored in an off-site vault.

Small businesses and home users can subscribe to a remote backup service, such as Atrieva, Safeguard Interactive, Telebackup, and @Backup. At night, your computer automatically dials a remote server and uploads your critical data. If something happens to your local data, you can download copies from the server, where it's encrypted and regularly backed up on tape. Many backup services will also send your files on a CD-ROM by overnight courier. View the monthly fee as an insurance premium. A cheaper method is to upload your most irreplaceable files to the storage area some ISPs provide. Encrypt sensitive files.

These precautions will become even more vital as electronic commerce, online banking, and home bill paying grow more popular. If a thief steals your computer, he probably just wants to fence the hardware. But what if he scopes your hard disk for data? He might find spreadsheets, tax records, account numbers, *Quicken* files, business memos, love letters, or saved games from advanced levels of *Quake*. Any of it could be much more valuable to a smart thief than your hardware—for identity theft or blackmail.

Centralized storage will also be the future solution for data synchronization. Some hardcore types already have an office PC, a home PC, a laptop, a palmtop, a smart cell phone, and a smart pager—each with its own database. If somebody's phone number or e-mail address changes, you have to update every database manually or plug each device into another device to share the data. Why not store the data on a remote server where all your devices can find it?

Spreadsheets, tax records, account numbers, Quicken files, business memos, love letters... Any of it could be much more valuable to a smart thief than your hardware.

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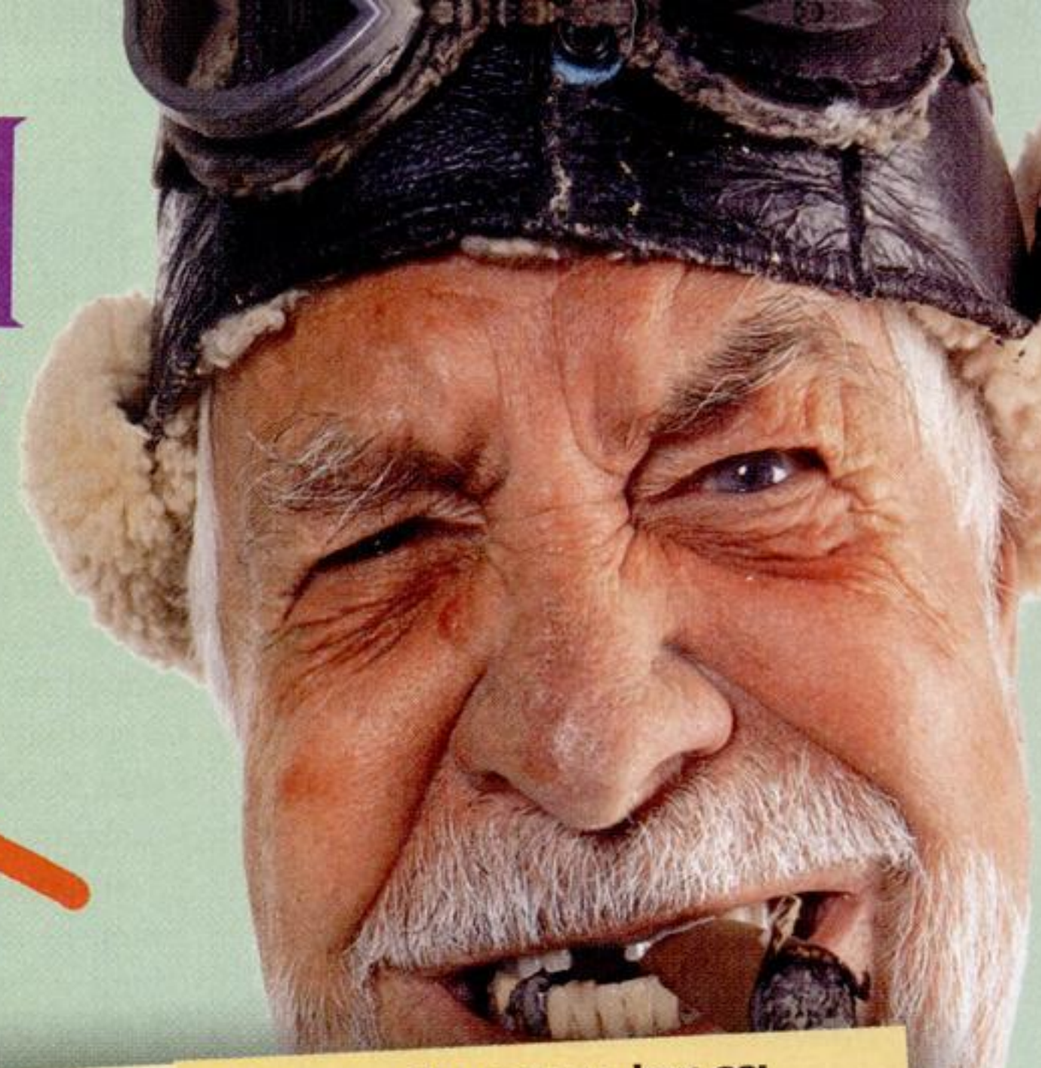

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ON THE LINE

XML: The Amazing Wonder Spec

COME ONE, COME ALL, AND WITNESS THE GREATEST MARVEL OF THE WEB SINCE HTML

The leader is rarely the winner. Just look at a corporate giant like Microsoft, which seldom breaks waves, but is always waiting to make things bigger, better, and ubiquitous in version 2 and beyond.

This same principle holds true with HTML.

While HTML has been central to creating a global networked cyberspace, it will be technologies such as XML that actually make it bigger, better, ubiquitous, and most of all, useful.

Like HTML, XML is a derivative of the SGML system developed by the W3C (World Wide Web Consortium) to extend hypertext. While SGML has been criticized as an overly complex and unwieldy mess with poor documentation, and HTML is knocked for being too weak, XML is simple and straightforward, and has gained the acceptance of a host of tool makers and developers. *Navigator 5.0* is expected to support the new protocol, and the current version of *Internet Explorer* already does. In fact, Microsoft is planning to build XML support into all its *Office* products by next year.

XML isn't a language per se. It's a system for defining other languages that separates structure and content from presentation. With XML, developers can separate their database content from their output style. And changing the style is not limited to font size, color, and other abilities found, for example, with Cascading Style Sheets (CSS). Changing views in XML means everything from page layout to technology display. While one person views data as a simple text table, others could explore the same data via a 3D universe, or access it through a phone-based interface.

XML will be the first technology to truly integrate our existing publishing, broadcast, and communication technologies.

The significance of this is staggering. Get custom-generated headlines from CNN Online delivered to your pager; get a visual representation of your various insurance policies, or get an automated phone call whenever your checking account drops below $1,000. As a bonus, you'll be able to mix and match these info-outputs any way you choose. Don't just customize your desktop, customize *all* your interfaces.

In the more pragmatic short term, XML offers improved hyperlinking functions. XML links are manageable as objects. These dynamic linking possibilities enhance the ability to assign actions to links for features such as powerful new search functions, without the need for JavaScript. For example, a link doesn't *have* to simply open a new page or hyperjump around anchor points on an existing page. An XML link can call a pull-down menu or launch a pop-up window. XML also offers more robust "style guide" options over CSS, a boon for designers concerned with page-layout specifications.

While XML won't replace HTML, it will most certainly revolutionize corporate web development. This said, anyone remotely close to this sort of web development—including producers, architects, engineers, project managers, and designers—should be aware of XML's evolving capabilities.

Anyone remotely close to this sort of web development—producers, architects, engineers, project managers, and designers—should be aware of XML's evolving capabilities.

While there are plenty of XML tools and resources, it should come as no surprise that both Sun and Microsoft are interested in the emerging power shift. It's obvious XML will be a close friend of Java—as a fellow open standard promoting "objectification" of the online universe—and Microsoft undoubtedly sees it as a smoother transition for getting its publishing and data viz products to the web. Microsoft, in fact, offers exceptional XML support at **www.microsoft.com/xml**, which includes not just the what and why, but a strong set of examples, source code, and possible extensions. Seybold held the first XML conference last winter and has a wonderful site at **www.xml.com**. The W3C, of course, has the spec and its evolution at **www.w3c.org/xml**.

Adobe, SoftQuad, Allaire, and Microstar are working on everything from export features for their existing publishing products, to entirely new tools for XML-specific and transaction-based system development. While the fate of this technology is still "uncertain and changing" according to most media skeptics, most everything in web land is "uncertain and changing," and this perspective shows a lack of conceptual understanding of the technology.

XML, like Java, is one of the few technologies finally planning for the long term of web development. Its significance comes in the realization that content should be separate from presentation, so that as the technologies for presentation evolve, we don't have to continually update the content too.

It's brilliant, if you ask me. ✹

SHEL KIMEN
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GAME THEORY

One of the grating cliches in computer gaming is that the technology tail wags the design dog. The media gnashes its teeth about the glorification of image over substance while simultaneously marveling about nonlinear mip-mapping. But a fundamental paradigm shift is underway that will move the quest for new technology to the back seat and place content at the forefront. This shift is being driven by out-of-the-box 3D-engine licensing.

In the olden days, there was id and not much else. Carmack's latest engine drove the newest id game, and third-party developers scrambled for access to the previous engine. Thus, id would release *Doom* and use its engine for its own *Heretic*, while giving companies such as Capstone the rights to the outdated *Wolfenstein 3D* engine. This worked because there was no competition in the engine business: there was only one John Carmack.

Unreal changes everything. The technology is newer and better than *Quake* well. It's simply that the *Quake* technology is hard to work with.

It's clear Epic/GT have struck gold with this approach to licensing, since scuttlebutt says the license costs $1 million per game. *Unreal* will almost certainly make more money through third-party licenses than through its own sales. This was largely happenstance, as *Unreal* creator Tim Sweeney told me: "The big goal with the *Unreal* technology all along was to build up a base of code that could be extended and improved through many generations of games. Meeting that goal required keeping the technology quite general-purpose, writing clean code, and designing the engine to be very extensible. The early plans to design an extensible multigenerational engine happened to give us a great advantage in licensing the technology as it reached completion. After we did a couple of licensing deals, we realized it was a legitimate business. Since then, it has become a major component of our strategy."

There's another key to *Unreal*'s success among third-party developers: support. id offers little but its tools to people using its engines. Epic, however, maintains an organized and efficient third-party support system to deal with any questions. With the license, the developer gets all the source code for the *Unreal* game, engine, and editor. Epic level designers visit licensees to get them up-to-speed on content creation, while programmers answer any technical questions.

Meanwhile, the question is "Whither id?" Carmack has been working on a project called *Trinity* for some time. Scratch-built technology designed to take full advantage of the latest hardware acceleration, *Trinity* has morphed into *Quake III: Arena*, breaking the id trend of creating a new franchise for each new engine. The head-scratching will continue when people actually see *Arena*, which is a deathmatch-only game. There's solo play via bots, but the levels are, at this point, being created as deathmatch-style brawls. The technology is indeed impressive, as befits a Carmack creation. Bezier-curve calculations allow true curved surfaces, and specular shading provides true shiny surfaces. Still, id has yet to show outside environments to equal those of *Unreal*, though they insist it can be done. There's no word yet on how easy the editor is to work with.

What all this means is that you'll be seeing *Unreal*-based games for a long time. There is other, more impressive technology on the horizon, such as *Prey* and *Trespasser*, that will certainly look and perform better than *Unreal*. If these prove difficult to work with, however, developers will stay with *Unreal*. The bean counters are all too aware of the cost of the huge delays associated with difficult technology, such as those suffered by *Daikatana* and *Half-Life*. They may well be willing to give up some of the "wow" factor of a *Prey*-engine game in favor of an *Unreal*-based game that can be turned around in six months.

The pay-off for gamers should be a shift in focus from technology to content that will lead to more interesting gameplay. ✹

T. LIAM MCDONALD
is a veteran game writer who secretly longs for a hardware-accelerated version of Ms. Pac Man. Attack him at **tmcdonald@maximumpcmag.com**

The 3D Engine Wars

UNREAL CHANGED THE RULES. WILL EVERYONE ELSE FOLLOW?

II. More importantly, the editor is lightyears easier to use.

The most crucial indicator of a shift in business practices is the plethora of *Unreal*-engine-based games already in development and, in some cases, set to ship mere months after the release of the original game. *Klingon Honor Guard, X-COM Alliance, Werewolf: The Apocalypse, TNN Outdoor's Hunting, The Wheel of Time, Deus Ex, Daikatana II*, and *Duke Nukem Forever* are all deep into development. All use *Unreal*, with the designers finding it a breeze to work with.

Meanwhile, *Quake II*–based games such as *Half-Life, Sin*, and *Daikatana* are lumbering to completion far, far behind schedule. That's not to say these are inferior games. Some look and play incredibly

The bean counters may well be willing to give up some of the "wow" factor of a Prey-engine game in favor of an Unreal-based game that can be turned around in six months.

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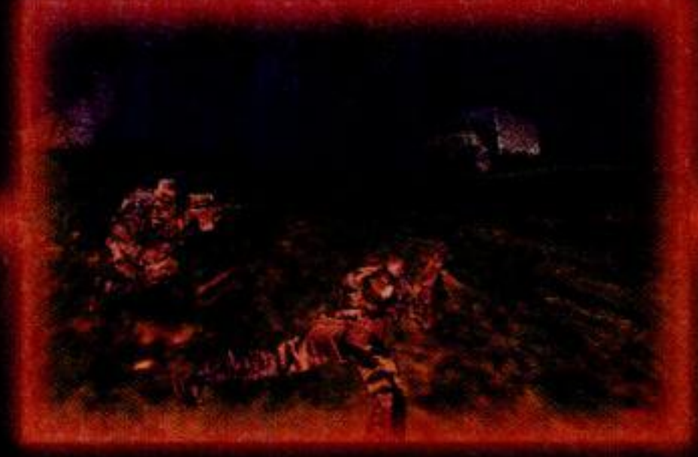

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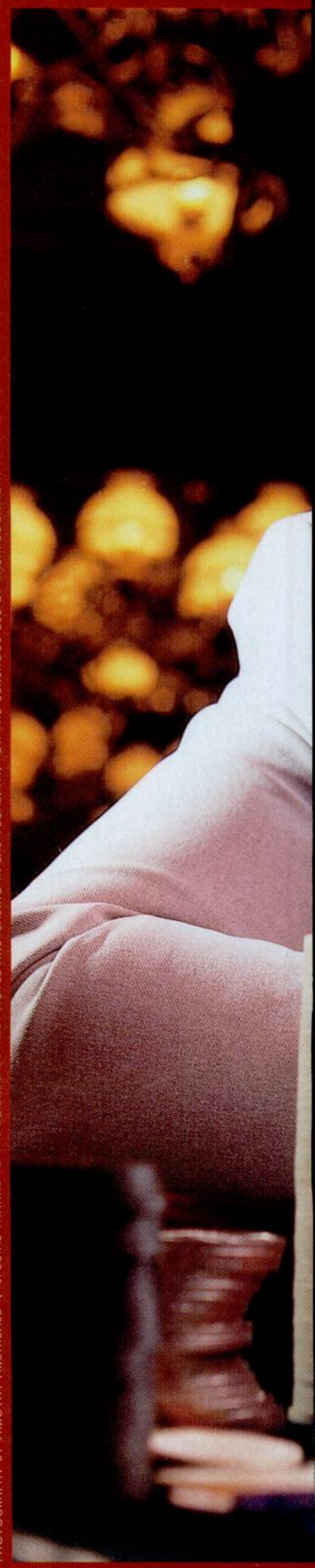

PHOTOGRAPHY BY TIMOTHY ARCHIBALD | SPECIAL THANKS TO THE BOURBON STREET HOTEL AND CASINO IN LAS VEGAS, NV. FOR THE GENEROUS USE OF THEIR LOCATION.

Maximum PC So what is Chromeffects?

Engstrom It's an attempt to make the HTML composition space completely multimedia-aware. If you had a piece of paper in your hand right now, you could bend it, fold it, staple it, mutilate it, or crumple it up. Chromeffects is about making every picture or piece of HTML text exist in a 3D space and then animating it, so you can move it around, push it away from you, or pull it close to you. You can also light it, shade it, and all the other things you could do in real life.

The human eye is very good at dealing with perspective, because everything in real life doesn't turn flat to face you as you're walking around. One of our favorite effects is tilting away pieces of the user interface that you're not using. You can still read it, but it takes up less screen real estate so more of your screen is available for what you're actually doing at the moment.

MPC Is there really a demand for this sort of thing?

Engstrom We live in a very information-rich world; in fact many think it's almost useless because we can't find any specific information or ingest it once we have found it. The goal with Chromeffects is to build a way to describe ideas visually.

I could write paragraphs of text describing my mental image of how a four-stroke engine works. When you read my description, your brain would decompress it, and if our English compressors and decompressors are compatible, you would understand exactly what I said.

I did this little test with five engineers and only one of them—a farmer who had previously torn engines apart—decompressed the thing correctly.

Our goal isn't to make presentation-quality multimedia; it's to make e-mail-quality stuff. Long-term, we see this as a way of actually communicating information, skipping the English compression and decompression phase.

MPC Why should consumers care about Chrome technology?

Engstrom Speed. Chromeffects makes your experience on the web faster. We made sure you

PROFILE

And he would be...?

Eric Engstrom is the Microsoft General Manager in charge of Chromeffects, desktop extensions that easily add 3D animations and text to web sites and desktops.

But you're going to have to pay to play.

And I would know him from...?

Engstrom was one of the founding architects of DirectX, which makes him uniquely qualified to oversee the Chromeffects development process, especially since the two are closely tied and work in conjunction with each other and Microsoft's operating systems.

And I would care because...?

Chromeffects represents a gamble for Microsoft. The technology is extremely exciting, and even better, remarkably easy to implement. And if Chromeffects succeeds, it will undoubtedly change the face of computing and web browsing. But the best technology doesn't always win.

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"Internet multimedia to date—such as Shockwave and VRML—has been a market flop. I'd like to think our technology is radically better."

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could easily author for Chromeffects, but at the same time preserve your page's current look if someone accesses it with a non-Chrome browser. In those situations, the pieces that Chromeffects cares about are simply ignored—you don't get any scripting errors or any of that annoying stuff. Even better, the alternate HTML or traditional content you need—the animated GIFs or what have you—is still there. But with Chromeffects you'll experience a much faster download experience for the same graphic content. That's phase one.

Phase two is allowing people to build an experience that just can't be done on the Internet today. You can do TV-quality graphics—not quite photo-realistic rendering mind you—but certainly better than you can get with animated GIFs. And since they are also very light to download, there's virtually no waiting.

MPC How does Chromeffects make the web faster?

Engstrom Chromeffects replaces the actual graphic file with just a description of what the GIF should do. Our best example is 3D text. With Chromeffects, a 70K animated GIF of a spinning brand name takes only 355 bytes.

MPC And how is this possible?

Engstrom We're rendering locally. Instead of sending down a pre-canned movie, we send down the description of how to make the movie. And then Chromeffects uses your 3D accelerator and your processor to render the movie on your computer. Basically we just pass messages.

MPC How much overhead does this represent for the receiving computer?

Engstrom Chromeffects is another 5MB or 6MB, and that includes the extra plug-ins from our third-party partners. One of the other things we did with Chromeffects is introduce DirectX Transforms, which allow Direct3D retain mode meshes to be modified and put back through this plug-in model. And it allows DirectDraw surfaces to be modified the same way. So if you go to one of these DirectX Transforms for image-to-image transfer, it can plug into any DirectX product that deals with images. We even have a *Photoshop* wrapper, so you can just register a *Photoshop* plug-in and it will work seamlessly.

And desktop support is fully integrated as well. Chromeffects goes wherever HTML rendering occurs.

MPC Does Microsoft view Chrome as a revenue generator?

Engstrom It's very easy to get wrapped up in building revenue, but it's not the reason we're doing it. Macromedia is a profitable company, so you'd have to think those guys figured out a way to make money in the space. But it's easy to build a bunch of technology, declare it valuable because you've shipped a bunch of units for free in the operating system and nobody had to do anything because the technology is just there.

Apple doesn't make much money off QuickTime, and RealNetworks has yet to turn a profit. Chromeffects is an attempt to turn multimedia into a billion-dollar industry. This market isn't very large, especially when you compare it to something more established like the game market. DirectX's goal was much more pure and easier to identify: Make it fast for sophisticated developers who are willing to put up with a lot of rough edges. The stuff I do now is probably more broadly applicable because it's a "multimedia for mankind" thing. But you end up having a hard time narrowing down exactly what problem you're going to solve, especially since Internet multimedia to date—such as Shockwave and VRML—have been a market flop. I'd like to think our technology is radically better than all the rest, but this isn't a billion-dollar industry, at least not yet.

This is the first time Microsoft's built a product that really pushes the envelope of high-performance machines. Generally our products are targeted more at the installed base, but when you're introducing a new space, which doesn't already have a value attached to it, there's no way to judge whether you're hitting the customer's needs.

MPC So do you view this as a paradigm shift for the home user?

Engstrom It is the start of a paradigm shift for the home user. Much like any first-generation product, you have a certain demographic of people who will adopt it first. Game players tend to fit in that space because they're the people who generally buy the newest and coolest computers first.

Then there are people using HTML user interfaces. Those customers will benefit a great deal.

MPC Can you give us an example of how an interface might differ under a Chrome-enabled desktop?

Engstrom There's a ton of experimentation going on in how to enhance the user interface with 3D. We have some really simple examples, almost all of them using perspective. For example, we have this demo of "My Computer" where on the left-hand side you have the tree structure of the files, and on the right-hand side you have the files in the directory that bends away. Guiding your mouse to a specific section on the screen, turn it into a search pane. Click again to turn it to something else. This one panel rotates like a lazy susan full of UI elements. We're not sure that's going to be the next greatest, most amazing UI widget ever, but it is the sort of thing people are now starting to experiment with.

MPC What lies beyond amazing interface widgets?

Engstrom The information-publishing stage is when the massive benefit kicks in, because ingesting information faster is a huge competitive advantage. Everybody needs to be able to get more stuff into their head.

MPC And how will everybody actually get Chromeffects?

Engstrom It comes on new computers. But OEMs—at their discretion—can also sell it to customers who already have computers that meet the minimum Chromeffects configuration. We're doing this, rather than going direct, because of the DirectX driver system-configuration issues. We want the people selling Chromeffects to make sure the customer has a great experience.

MPC And how much is this "great experience" going to cost us?

Engstrom No idea.

MPC Is there a ballpark? $100, $200, $300?

Engstrom Oh, it would be very much under $100.

MPC How much do OEMs pay for Chromeffects?

Engstrom It's very inexpensive.

MPC Is $2 to $3 in the ballpark?

Engstrom No comment.

MPC OK, how about this: Have any OEMs said, "No, not interested?"

Engstrom No. I don't work in the OEM sales group, but I've personally been to a lot of OEMs, and the reaction from them has generally been very positive.

Right now the distinction between a

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low-end PC and a high-end PC is a little card in front of the PC that says it has a lot more MBs and a bigger number of MHzs. Most consumers don't necessarily understand that. Imagine going to buy a car and the difference between the cheap car and the expensive car was that the expensive car had a "5.0L" next to it instead of a "3.0L". Most people know it's a bigger litre engine, but what if there was nothing else—no radios, no leather seats, no chrome? One of the things Chromeffects provides is a user experience that is visually and startlingly superior.

That's something OEMs understand.

MPC But most big companies are still hesitant to buy high-end PCs, right?

Engstrom Corporations are hesitant to waste money. That's not terribly surprising. Chromeffects 1 was targeted basically at the Internet, not at the intranet. But Chromeffects 2—with data visualization technologies—makes workers more productive. Computers get purchased in the first place because they allow work to be more efficient.

Chromeffects raises that bar.

MPC Still, some would accuse Chrome of being a carefully orchestrated ploy to sell high-priced Intel machines running Microsoft OSes.

Engstrom Chromeffects is designed to make our operating system more attractive to customers. I don't think that's necessarily a "ploy." We all try to improve our products to make them more attractive and provide more value to our customers. The reason Chromeffects targets higher-performance computers is the raw performance we needed to make it work. A game may run just fine on a less-powerful processor today because it's highly tuned by a master craftsman, but Chromeffects is designed to be coded by someone using Notepad, somebody who knows nothing about 3D and doesn't even know a Z-buffer exists.

MPC How long before the majority of consumers have hardware powerful enough to run Chromeffects?

Engstrom Our estimates show that 60 million computers sold in the next year alone will include Chromeffects.

MPC Installed base is one of the keys, but as you mentioned earlier, Shockwave and VRML have been a flop. Why...

Engstrom [interrupts] No, I just said they hadn't been a huge market success.

MPC I'm pretty sure you actually used

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the word "flop."

Engstrom [look of horror] Oh, I hope I didn't!

MPC In any case, why will Chromeffects be any different?

Engstrom We're hoping Chromeffects can expand the multimedia market because it moves the authorability in that space from 50,000 professional multimedia authors to pretty much anybody that can use Notepad. Our intention is to make it so you're authoring in e-mail. It's not hard. It's more like an instant camera—you just point and click, and you get a picture.

MPC Despite that ease of use, do you have fears that Chromeffects won't be a success?

Engstrom I don't have any fear that Chromeffects won't be a success. My concern is the speed at which it can be adopted. I just have no idea. Is it something that takes six months or does it have an adoption curve like the one between Windows 1 and Windows 3 of six years? That's a lot of variability.

MPC So when will Chromeffects first be available to the general public?

Engstrom The product is available to OEMs now; the SDK is available to developers now. But because of the way OEM manufacturing works, there's a lag between when we finish and when they deploy.

MPC And how long was Chrome actually in development?

Engstrom People have been coding for about 14 months, but it was a good four months from our first napkin drawings to the actual tag specification and modifications we'd have to make to *IE*. We had to learn a lot!

But you should start to see it bundled with systems this fall.

MPC That's quite a surprise from Microsoft, of "Windows 97" fame! When Chromeffects was first announced, you projected a mid-1999 release date. What happened to accelerate the ship date?

Engstrom We were able to bring the schedule in dramatically based on two things. First off, the development team decided it didn't want to miss the Christmas OEM cycle. They haven't missed a Christmas in four years. Second, we basically took a whole set of the functionality and just moved it off to next year, without affecting what we thought was the baseline of the product.

MPC So what features were intentionally left out of version 1?

Engstrom The stuff we pushed off to version 2 was mostly the data visualization technology, things such as improved 3D picking. Previous to Chromeffects, there was no model in Windows, or any mainstream operating system, to handle dragging-and-dropping in a 3D space.

We were going to put that in, but our feedback showed that while people are very excited about it, they hadn't quite gotten to the point where they're using that specific feature. We decided it was probably better to get it out in the hands of a bunch of end users and developers and get some real honest-to-God feedback, rather than having us just continue to rub our temples and pretend to see into the future. We're not a research group; we're a product team.

And Chromeffects 2 will update smoothly on top of any Chromeffects 1 machine. You're not going to have to buy another machine! [laughs]

MPC Are there Chromeffects features that you know won't make it into version 2?

Engstrom There's at least three years full of stuff we want to accomplish.

For example, video-conferencing cameras are getting really cheap, right? Well, wouldn't it be cool to have computers that look at you, recognize you, and log in for you? You don't want this in a secure situation, but it would be very cool as a home user. You just sit down and the computer knows who you are and adjusts everything the way you want it.

The thing I'm most excited about is the ability to search on those 3D models. I have some biologist friends who work with an E. coli that has a little electric motor that spins its flagella at about 15,000RPM. It's smaller than the smallest motor they've been able to build in nanotechnology, but my nanotech friends didn't even know a motor like that existed, because the biologists don't call it an electric motor. They have a long Latin name for it. Nothing in our searching infrastructure allows you to search for concepts. You have to search for words. If you don't know what some other discipline calls something, you're probably never going to find it. But a future version of Chromeffects will be able to search on concepts. That's when things really start to get interesting!

MPC So when's the next version of Chromeffects?

Engstrom We'd like to ship in time for the OEM cycle every year. It's the same philosophy we adhere to with DirectX.

MPC DirectX updates are free. Will we have to pay for Chromeffects 2?

Engstrom It's a product. I would say that

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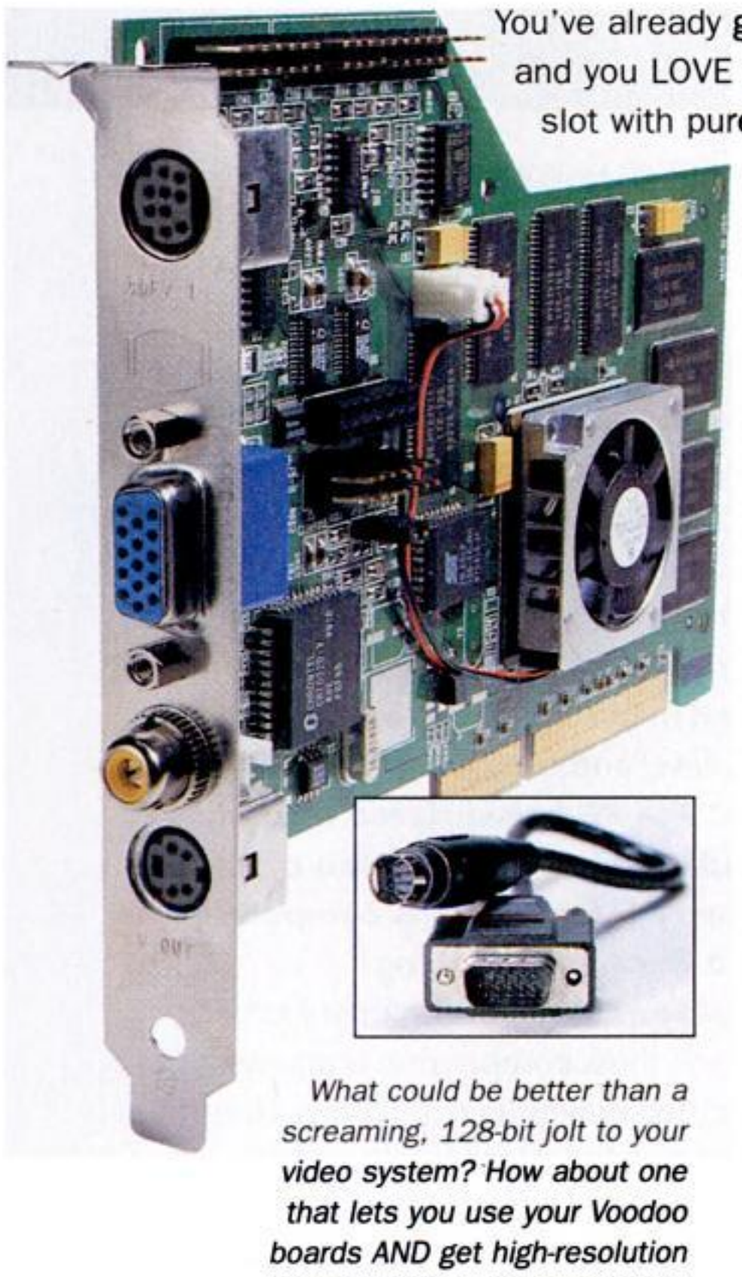

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it is probably more than a possibility.

MPC Currently Chromeffects works only with Microsoft's own Internet Explorer browser. When will Chrome extensions come to Netscape's Navigator?

Engstrom Chromeffects is deployed as an ActiveX control. That means it's part of Windows. So if, or when, Netscape delivers the ActiveX support they've been promising for the last two years, Chromeffects will work. Of course, I understand schedules, and Microsoft is not in the business of pointing out other people's schedule slips, especially since the same thing has happened to us.

MPC Has Netscape expressed interest in Chromeffects?

Engstrom No, not to date. If they did, we're more than willing to work with them. Heck, we'd be delighted to get that to work. I'm in the business of making Chromeffects ubiquitous. Every ISV I can get,makes Chromeffects more ubiquitous.

MPC Sure, but what happens if Chromeffects becomes ubiquitous before Netscape gets its ActiveX stuff working? Will Microsoft take a hit for more monopolistic practices?

Engstrom I don't know how to make Chromeffects work other than as an ActiveX control. I don't really think it's unreasonable for Microsoft to say, "Here's the plug-in model to use on Windows. You may use this plug-in model all you want to and here's this piece of Windows that plugs in that way."

MPC How about the Macintosh platform—will Chromeffects work there?

Engstrom No, Chromeffects is Windows technology only.

MPC We've heard that DirectX was originally conceived to knock Apple out of multimedia. Could Chromeffects have the same effect on the Internet?

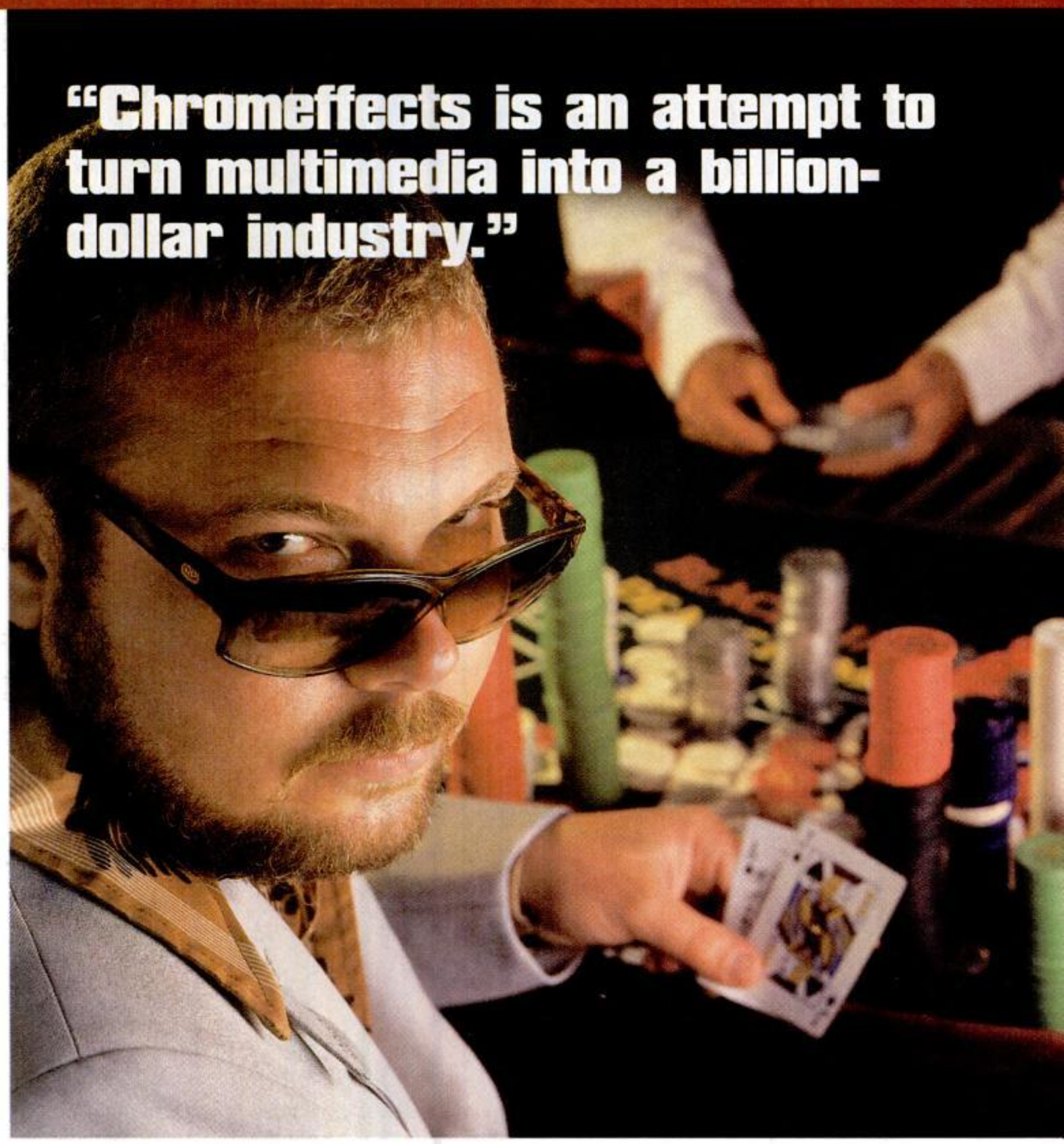
Engstrom No. DirectX was originally conceived to address the needs of the game development community, literally to make their problem with DOS compatibility go away.

MPC But Chromeffects won't work on non-Windows OSes. Do you expect to get heat for that from the DOJ?

Engstrom No.

MPC Do you care?

Engstrom Well, obviously I care. It's not my intention to generate any heat, especially with the U.S. government. I'm very proud to be a citizen of the country. But it's Windows technology, right? It's applicable on the web. We certainly have no problem



with someone doing similar things on other operating systems. We make it easy for people who are building browsers to take advantage of Chromeffects on Windows.

What else could you expect us to do?

MPC What about licensing the source for Chromeffects? Is that ever going to happen?

Engstrom That's a lot of source code to license. It would have to include the license for the source code to DirectX—Media and Foundation—all the way to *Internet Explorer*, and probably the next revision to the GDI end-user interface. Where do you stop?

MPC What about graceful degradation for Chrome-incompatible browsers?

Engstrom [excited] We actually have some really cool tools. For example, your existing web page contains an animated GIF. You can wrap the Chromeffects language, the object tag, and the description of what you want to do around that animated GIF and the associated HTML. If Chromeffects is loaded, it will ignore that old description. If Chromeffects isn't there, the Chromeffects object and all that description is ignored by the browser. Your original GIF gets downloaded and runs. You can even author using Chromeffects. We have a tool that generates animated GIFs directly from the Chromeffects language. You say to yourself "Gee, wouldn't it be great if I could take this 3D text I just described in two or three lines in Notepad and turn it into an animated GIF spinning at 10fps?" Bam! Chromeffects will create an animated GIF, which can then be placed in the old HTML section. It's an SDK-level authoring tool.

MPC The PC has suffered from mixed standards, but competition drives the industry forward. So is competition a good thing or bad thing?

Engstrom I'm an evolutionary kind of guy, so I think competition is an awesome thing, personally. It creates an environment where new ideas can grow and where the end user gets to decide what they want and what they don't. And that's what you're competing for in the end, right? You're not competing to build a better product in a theoretical sense to win a theoretical prize—you're competing to deliver a better experience to the end user.

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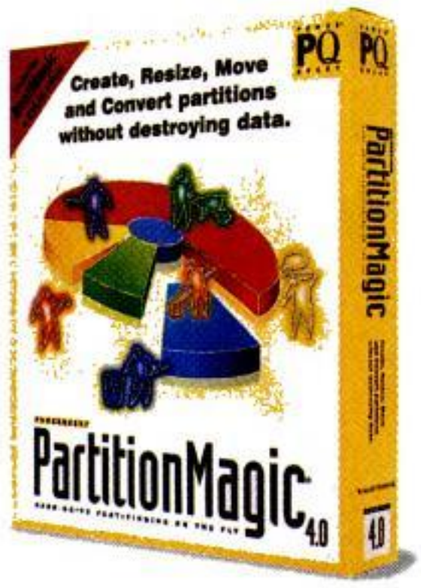

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We put 10 new next-generation Digital Cameras to the test in our decisive shootout

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ELMANIA

As digital camera resolutions continue to go up and camera prices creep down, there's never been a better time to take your photography digital. We took 10 of the top cameras available and put 'em to the test in our head-to-head shootout. Many cameras in this year's roundup would have qualified as pro gear only a few years ago—and come with pro price-tags as well. But now they can be had for the same money as a top-of-the-line SLR rig.

Make no mistake, these cameras are still not in the SLR range when it comes to certain features, namely optics. Even the lowliest 35mm SLRs sport interchangeable lenses that blow away even the biggest glass in this year's shoot out, not to mention the contact lenses some of these digital models come with. And you aren't looking at interchangeable until you get into Kodak's pro line at around $7,000 (depending upon configuration). But Sony promises some surprises next year in its DSC line…

In the meantime, why bother going digital? Well, nearly all these cameras boast megapixel resolutions, allowing you to make prints that are nigh indistinguishable from traditional Fotomat fare. (Even better, the high school kid behind the counter won't be able to make dupes of all those nude pictures your girlfriend took of you.) While many of these cameras claim to make great prints at up to 8x10-inches, we'd recommend staying below 5x7 for best results.

Why make prints that just end up yellowing in some shoebox stashed in your closet? It's the 90s, and nowadays we do things digitally. Grab some snaps and e-mail 'em to everyone you know. Forget the family vacation slide show; post a media-rich account of your adventures on your personal web site. And never rummage through envelope after envelope of negatives for that picture of your first true love; many cameras come with utilities to sort your pictures in electronic photo albums with powerful search engines.

Many of this year's digital cameras also include audio-recording features that allow you to caption your shots with voice annotation—or capture ambient atmosphere sounds—for future identification or to give your slide shows that multimedia air. This can be especially useful if the police are involved.

Given all this, it's obvious that digital cameras have definite benefits over your traditional SLR. So get out there and start filling those golds. The world waits for no photographer.

—Brad Dosland

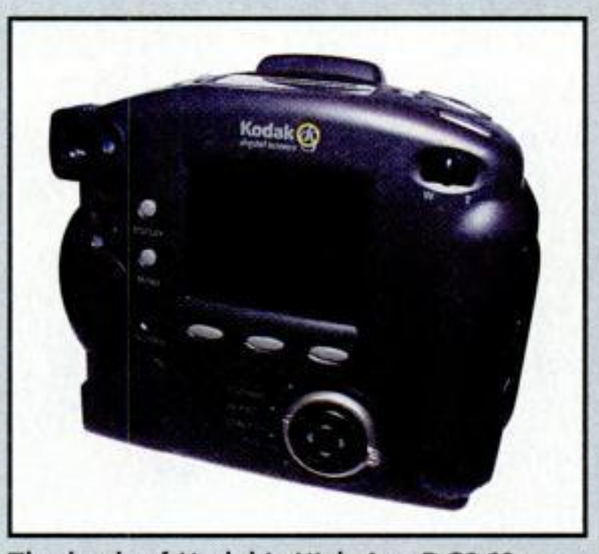
LEAD PHOTOGRAPH BY JACK HUTCHESON, PRODUCT PHOTOGRAPHY BY AARON LAUER

Kodak DC260

MAXIMUM PC KICK-ASS! product

The first name in traditional photography is the name on the most impressive camera in this year's shootout. Kodak's DC260 defines the state-of-consumer-level digital photography.

All this goodness begins with the highest actual CCD resolution in this roundup. The DC260 clocks in at a robust 1536x1024 pixels of crisp detail (albeit with some visible artifacting at extreme magnification). These big, rich images are given equally spacious accommodations by the 8MB CompactFlash card that comes with the DC260; there's room for some 14 pix at max res. And when it comes time to get those images to your PC, the DC260 won't make you suck beefy image files down a serial cable. The camera comes with USB support, which promises transfer speeds 10x faster than serial, and IrDA transfer for when you just can't be tethered.



The back of Kodak's Kick Ass DC260 looks more like a full-fledged PC than a mere digital camera.

Despite all this goodness, the single-most welcome feature on the DC260 is the long-awaited addition of an external flash sync. This simple port allows you to use studio lights and external flash with the DC260. Compared to the pathetic on-camera flash most point-and-shoot models offer, this option allows vastly superior lighting, which is really what puts the "photo" into photography.

Another innovative feature is a custom scripting language that allows shooters to create macros that perform a sequence of events with the touch of a button, complete with prompts on the camera's preview LCD. Scripts can even modify existing menus or add new menus and choices.

In fact, the DC260's entire interface is superb, from the friendly on-screen controls to the camera's compact ergonomics. Details such as a considerate divot for your left thumb and a gamepad-style controller button for navigating the LCD illustrate the attention given the DC260. Only the position of the power switch (poorly positioned next to the main shutter trigger) mars its perfection. And some might fault the sturdy camera for its considerable heft.

The DC260 includes an audio recording feature and makes effective use of audio feedback with a digitized shutter sound.

Add in an exceptionally strong software bundle that even includes Adobe *PageMill* for getting your snapshots posted on your web site, and you've got this year's stone-cold best camera.

MAXIMUM PC VERDICT

Price $999
Company Kodak
Phone 800.235.6325
URL www.kodak.com

10

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▶ Ricoh RDC-4300

Ricoh has earned its stripes in the digital camera world with generation after generation of ever-improving digital cameras, culminating in the RDC-4300. This pocketable progeny has much to recommend it.

The sturdy brushed-metal body is reminiscent of Minolta's unfortunate Dimage, with its pivoting camera head. But this time out, image quality is much improved.

An intriguing design consideration of the RDC-4300 is the enclosed flash on the main body that pivots with the camera head. It would have been even better if you could lock the flash for bounce lighting effects, but that would probably require a more powerful flash unit. Another nice touch is the slight warming lens on the flash, for softening the chilly blue cast most flashes deliver.

The RDC-4300 employs the same 3x optical zoom seen in many of the better cameras in this shootout, but wisely forgoes the inferior 2x additional digital zoom, which degrades image quality.

Bonus features include the ability to capture audio (and an earphone jack for reviewing those sounds in private), a helpful introductory videotape, and an included Ni-MH battery charger to save you on alkaline bills.

All in all, the RDC-4300 is a very strong digital camera for the dollar.

MAXIMUM PC VERDICT

Price $599
Company Ricoh
Phone 800.241.7367
URL www.ricoh.com

8

▶ Toshiba PDR-M1

The PDR-M1, from notebook giant Toshiba, has all the makings of a great camera, but falls short in the execution of key features.

The camera's CCD stretches out with an odd-but-spacious 1352x1070 resolution, which it immediately downsamples to 1280x1024. This is also an uncommon resolution, given that most cameras in this shootout opt for 1280x960.

Image quality is on the low end of the spectrum, with significant color casts and less detail than other contenders. Zooming in on images reveals noticeable artifacting, especially in darker areas.

Speaking of zooming in, the PDR-M1 opts not to include an optical zoom, and instead went with just the 2x digital zoom, which does nothing to improve image quality.

In all fairness, this camera's image quality is far better than the bulk of last year's models and worlds better than the Vivitar. It's just that, across the board, the ante has been raised when it comes to this crucial factor.

Further handicapping the PDR-M1 is an anemic software bundle, uncomfortable knobby body texturing, and an awkward delay on the shutter trigger that leaves you wondering if you actually got the shot.

The mode dial doubles as a thumb rest, which can lead to inadvertently switching out of record mode. But it also features a cool gamepad-style controller button.

Overall, a close call for Toshiba.

MAXIMUM PC VERDICT

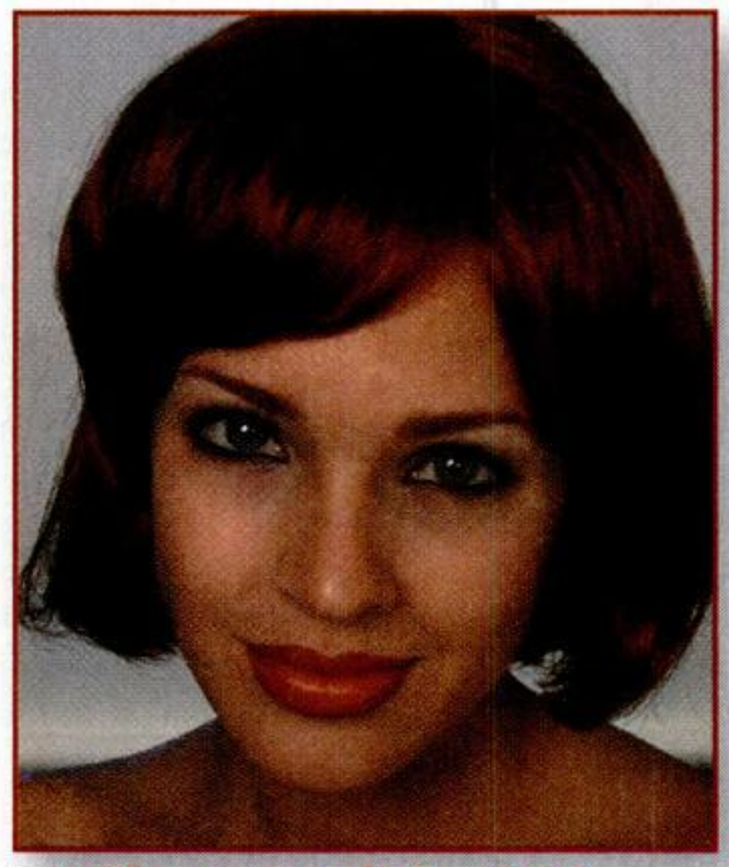
Price $599
Company Toshiba
Phone 800.334.3445
URL www.toshiba.com

6

▶ FLESHTONES

Since people are the single-most-common subject matter for most photographers, the fleshtone test is imperative for digital cameras. Our test was taken using the same setup as this month's cover image. We used a mix of a skylight and flash modeling lights, but disabled the flash slave and on-camera flash to get the most straightforward color balance. The lighting was a mix of incandescent and window light typical for any indoor daytime photography. We were surprised by the slow shutter speeds required to get properly exposed images, so many of the images resulted in subtle motion blur from camera movement due to slow shutters. Even so, many of the images display significant color shifts.

▶ Ricoh RDC-4300



▶ Nikon CoolPix 900

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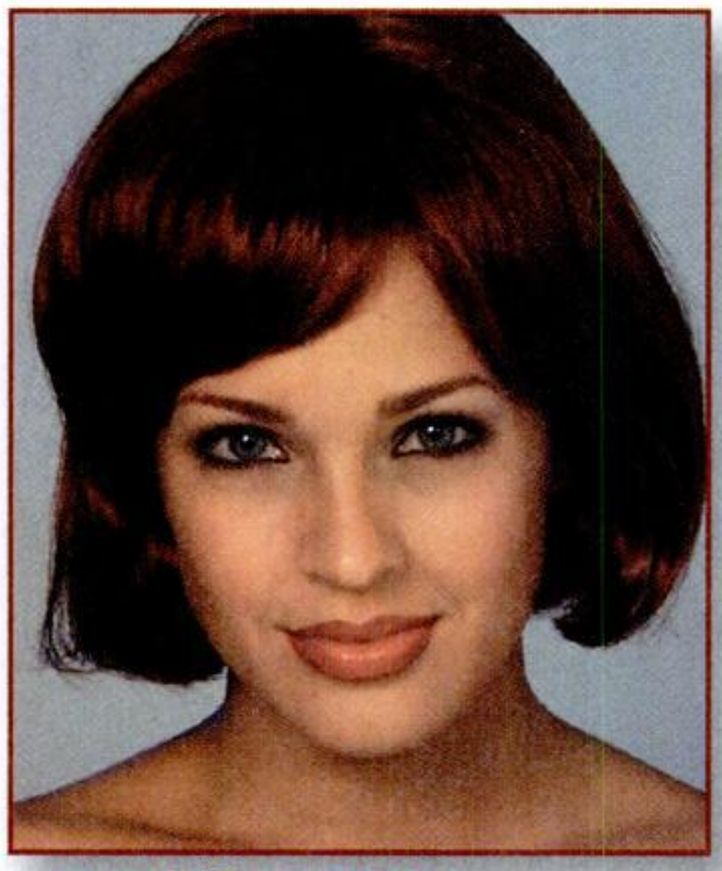
▶ Film

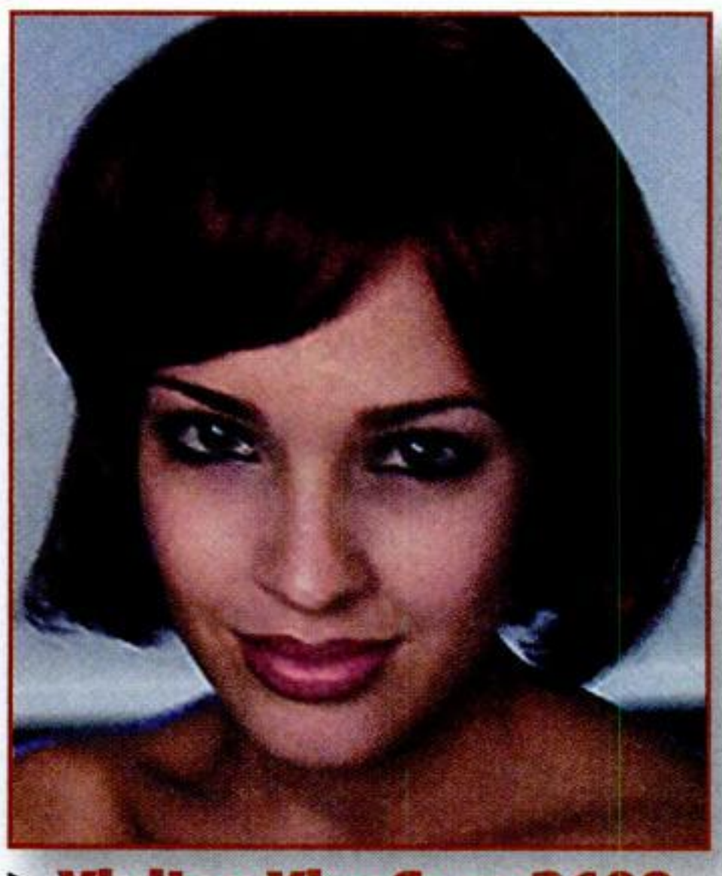


▶ Kodak DC260

▶ Toshiba PDR-M1

▶ AGFA ePhoto 1680

▶ Olympus D-340L



▶ Vivitar VivaCam 3100

SmartMedia vs. Compact Flash

Removable media: A digital camera has to have it, but which of the two formats is right for you? This year's shootout includes four SmartMedia-based cameras and two or three CompactFlash models (depending on whether you count the Vivitar PCMCIA camera, which is CompactFlash-compatible but doesn't come with it).

SmartMedia is the relatively new kid on the block and has taken the digital camera world by storm. SmartMedia goes straight from the camera and into a FlashPath adapter, which you then plop straight into your floppy drive for instant access to images.

SmartMedia

Currently, SmartMedia is available in sizes up to 8MB and is considerably more expensive, megabyte-for-megabyte, than its CompactFlash kin. 16MB capacities should arrive any day now, but herein lies the rub. Despite its name, SmartMedia isn't all that smart. The firmware that supports the format is hard-coded into the camera, and existing cameras that employ the format are having trouble making the move to larger capacities. Companies are scrambling for a fix, but until then, the road stops abruptly at a miserly 8MB.

CompactFlash doesn't have this road block. We've tested 48MB modules from market-leader SanDisk and love the freedom they afford. And with the release of 48MB models, prices for 16MB and 32MB parts will plunge, making expanded storage affordable.

High-end companies, such as Lexar, say memory speed is an important consideration when it comes to buying CompactFlash memory, and they point out that slow CF leads to slow write times and more of those unbearable delays between digital shots. We tested Lexar's 8MB CF card against an 8MB card from SanDisk on some of the cameras in this roundup and

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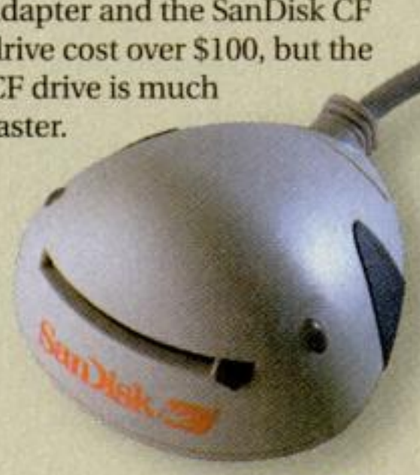
continued from page 59

found negligible difference in performance. The exception was the Kodak camera, which experienced notable improvement. You should test the more expensive media in your camera before making a decision.

Lexar Digital Film Kit

The biggest limitation of CompactFlash memory is the hurdles it needs to jump getting to the desktop PC. Sure, CF can be plugged into a simple adapter and transferred to any notebook PC with a PC card slot, but unless you're a road warrior with the right gear, you have an uphill climb taking your pictures to your desktop PC. There's no floppy adapter... yet. Getting images from these cameras requires either a serial connection (slow, archaic, and frought with bugs) or a drive capable of reading either PC cards or, better yet, CF directly. SanDisk makes an excellent CF drive that plugs into your parallel port and draws power from the keyboard port. Simply pop your CF cartridge into the hockey-puck-sized external drive and a beep sounds once the drive is recognized. Images are then available in the new drive directory.

Both the FlashPath floppy adapter and the SanDisk CF drive cost over $100, but the CF drive is much faster.



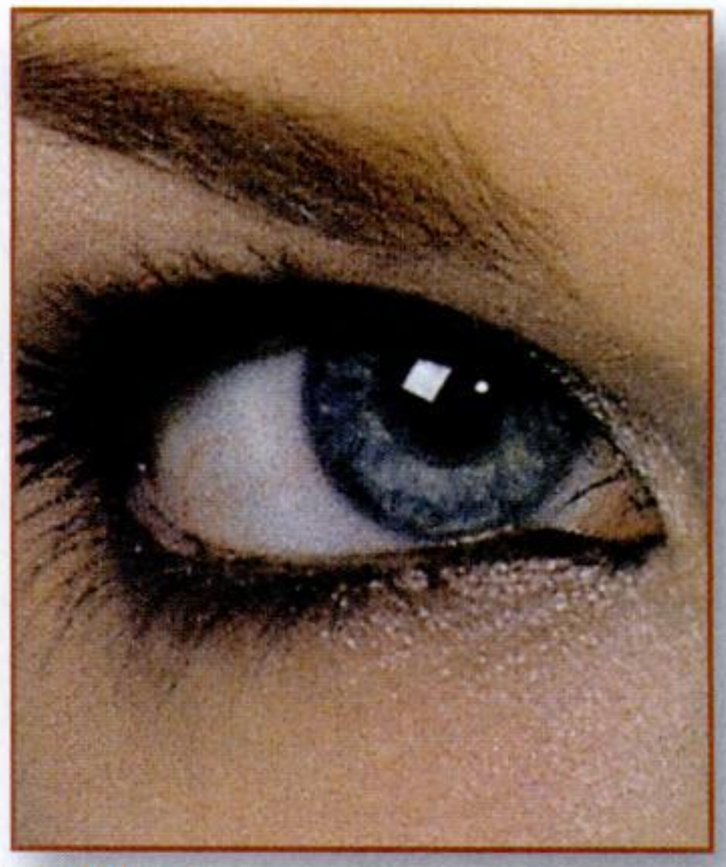
SanDisk CF Drive

If SmartMedia can solve its compatibility problems, it has the momentum to succeed. But the genre is evolving rapidly and few companies can afford to wait. In fact, we've heard off-the-record info that many major names are looking into CF for their next-gen offerings.

▶ ARTIFACTING

All digital cameras employ some form of image compression in order to fit high-resolution images into their limited storage. Most cameras are native JPEG devices, which is a compression algorithm that loses image data relative to how aggressively the codec is employed. Every lossy compression scheme creates interpolated image data, known as artifacts, and appear as clots of color and visible patterns in solid areas. Most of the cameras in this year's shootout have eased back on the level of JPEG applied.

The Agfa ePhoto 1680 and Kodak DC260 delivered the cleanest images, with the Olympus and Nikon cameras coming in close behind. The Ricoh RDC-4300 and Vivitar 3100 brought up the rear under close inspection.

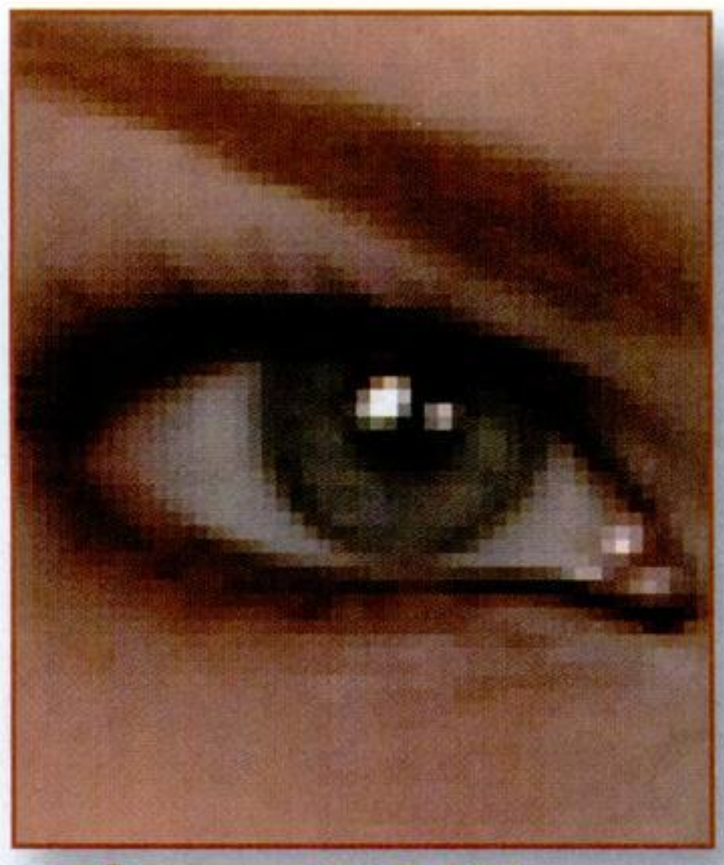


▶ Film

▶ Ricoh RDC-4300

▶ Toshiba PDR-M1

▶ Nikon CoolPix 900



▶ Olympus D-340L

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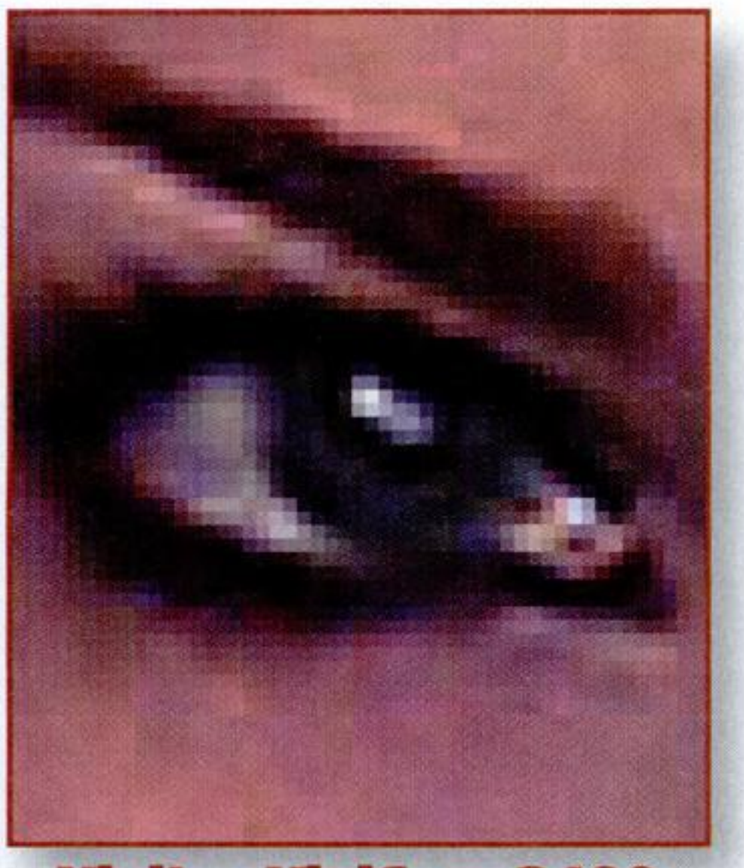
▶ Kodak DC260

▶ AGFA ePhoto 1680



▶ Vivitar ViviCam 3100

▶ Agfa ePhoto 1680

Last year, *Maximum PC*'s predecessor—*boot* magazine—received Agfa's 1280 too late for inclusion in its 1997 shootout. Good thing for last year's contenders, because the 1280 built on the tradition of exceptional image quality established by the company's lowly ePhoto 307. This year's model, the ePhoto 1680, takes the standard to new heights.

The improvements begin with a boasted resolution of 1600x1200. Unfortunately, all this gold doesn't necessarily glitter. The camera's CCD is actually limited to a more earthly 1343x972, but this still proves ample even through the upsample algorithm.

The swivel-lens design is comfortable to shoot with and replaces last year's identical black design with a silver skin. The body retains all its predecessor's awkward traits, such as a battery door that wants to pull open when shooting, a panel covering the ports that loosens with wear, and a nested door for the SmartMedia that requires twisting the lens like a Rubik's Cube for access. And, unfortunately, this year's model doesn't add a rangefinder for shooting in bright locales.

Nonetheless, the LCD does double as a capable interface for image information and simple icon-driven camera settings. In fact, while not as bells-and-whistles-heavy as Kodak's, this LCD implementation is among the best we've seen.

The 1680 is big. It sports big glass (with a big 46mm threaded mount for screwing on all sorts of SLR filters), but it is also too big for most pockets. This ain't no Minox. Luckily, Agfa provides a great pleather carrying case that can be carried with a strap over the shoulder or attached to the belt for Quickdraw McGraw action.

Bottomline: The Agfa ePhoto 1680 is easily one of our favorite cameras to take on the road.

MAXIMUM PC VERDICT

Price $899
Company Agfa Gaevert
Phone 800.879.2498
URL www.agfa.com

9

▶ Nikon CoolPix 900

Ultimately, the CoolPix 900 is mildly underwhelming, given its exceptional pedigree and pricetag. Pictures are bright and colorful, but somewhere between the precision Nikkor lens and the final images, minor detail is lost. Artifacting is minimal, so the culprit is most likely not an overly aggressive compression algorithm.

The brushed-metal-encased body design has some quirks as well. It's one of the biggest camera's in this year's shootout, and the swivel head occupies nearly half the entire boxy body, which is ergonomically awkward when shooting. Granted, this is something many photographers will grow accustomed to, but other cameras simply don't have this issue.

Nikon made a great decision by including a rangefinder (a godsend on sunny days when glare obscures the LCD screen), unlike the similarly designed Agfa 1680.

This isn't a bad camera, but you expect the best from the "Nikon" name and $900 pricetag.

MAXIMUM PC VERDICT

Price $899
Company Nikon
Phone 800.529.4566
URL www.nikon.com

7

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Olympus D-340L

Following on the heels of last year's hottest digital camera, the battery-devastating D-600L, Olympus' update to its 300 series was hotly anticipated. The svelte redesign delivers serious resolution but sacrifices features offered by competitors.

Most noticeably absent is the optical zoom. The only "zoom" feature to be found on the D-340L is an odd cropping tool that captures only part of the CCD image in a low-res file. Don't be misled into thinking this is a full-fledged continuous zoom lens.

While in low-res mode, the D-340L also offers burst mode, which allows sequences of 5 to 10 shots at 2fps. That's extremely liberating for anyone who has suffered through the frequently lengthy write times of other cameras.

As we'd expect from the creators of last year's hotshot, image quality is superb, with excellent color accuracy and nearly non-existent artifacting. Pixel-for-pixel, the D-340L holds its own, but feature-wise it fails to impress. We'd still go with last year's big glass D-500L, which sells for the same price.

MAXIMUM PC VERDICT

Price $699
Company Olympus
Phone 800.347.4027
URL www.olympus.com

7

Vivitar ViviCam 3100

Sure, it's cheap, but...
The Vivitar 3100 is easily the worst digital camera in this roundup. In fact, it's one of the worst digital cameras you're likely ever to suffer through. If price is all-important to you, buy last year's sub-megapixel model. Buy a used digital camera. You'll be a lot happier.

Let's start with the camera's "megapixel" status. The camera's box brags about "3-megapixel output," which is far more than any other contender in this shootout. Unfortunately, all that image resolution is interpolated up from the meager 1024x768 CMOS sensor, which produces substantially sub-megapixel images. And it shows in image quality, which is far and away the worst of this shootout.

Also worst in this shootout is the camera's paltry features list. No zoom lens, no preview LCD, no focus mechanism, brutally spartan controls, minimal documentation.

Without an LCD, you're forced to rely on the camera's rangefinder. But unfortunately, the rangefinder is so distorted that accurate shot framing is flat-out impossible.

Even the few features the camera does have are compromised. The 3100 is CompactFlash-compatible, but it comes with a retro PCMCIA card instead (and with an anemic 2MB capacity).

Oddly, this bare-bones entry does contain an audio-capture feature, although its shared mike/speaker assembly and awkward implementation render it nearly useless.

And the six AA batteries make the flimsy plastic body unnecessarily bulky.

But did we mention that it's cheap?

MAXIMUM PC VERDICT

Price $499
Company Vivitar
Phone 805.498.7608
URL www.vivitar.com

2

COLORQUALITY

For this test, we used a primary red and blue shoebox sitting on a rainbow colored floormat, The canvas on the shoes is off-white, while the rubber portions are stark white. We took the photographs in open window light and used the cameras' onboard flash to maximize color reproduction. The most subtle aspect of each image is the reproduction of the shoe's different white hues and capturing the green in the carpet.

This race was tight, but the Agfa ePhoto 1680 gets the nod for accuracy. The only discrepancy is a mild blue cast, undoubtedly created by the on-camera flash.

Once again, the Kodak and Olympus cameras were also in the hunt, but the Nikon CoolPix 900 did particularly well with color reproduction.

Ricoh RDC-4300

Nikon CoolPix 900

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▶ **Film**

▶ **Kodak DC260**

▶ **Toshiba PDR-M1**

▶ **AGFA ePhoto 1680**

▶ **Olympus D-340L**

▶ **Vivitar VivaCam 3100**

Other Contenders

In this fast-moving category of technology, new gear is constantly coming out. In the coming months, look for new models from Minolta, Sony, and even an update of Olympus' mighty D-600L.

Other cameras we looked at for this feature, but just didn't have room to review fully, include:

Casio's QV-5000SX: Following disappointing initial forays, Casio steps up with this 1280x960 camera that comes with 8MB of flash memory. Unfortunately, the QV-5000SX's storage is built-in. No digital film for you. Digital zoom is limited to a fixed 2x and 4x magnification, and the latter is only possible in low-res mode.

Epson PhotoPC 700: The latest from Epson also steps up to 1280x960 for considerably better pictures than previous models. The PhotoPC 700 comes correct with a 4MB CompactFlash card, low-res-burst mode, auto-focus, and a port for attaching the camera directly to any of Epson's exceptional line of color printers.

Fujifilm DX-9: While not a megapixel camera, at the modest 640x480 resolution, the DX-9 from Fuji represents the best of its class. With a long-lasting rechargeable lithium-ion battery and a 3x optical zoom, this small wonder runs on SmartMedia and lacks only video-out and a lens protector.

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▶ Head to Head: Megapixels Hit the Mat

	Agfa 1680	Kodak DC260	Nikon CoolPix 900	Olympus D-340L	Ricoh RDC-4300	Toshiba PDR-M1	Vivitar 3100
Resolution	1600x1200*	1536x1024	1280x960	1280x960	1280x960	1280x1024*	1920x1600*
Focus	auto	auto	auto	auto	auto	auto	fixed
Removable Memory	4MB SmartMedia	8MB CF card	4MB CF card	4MB SmartMedia	4MB SmartMedia	4MB SmartMedia	2MB PCMCIA
Hi-Res Images	6	14	8	7	6	5	4
Zoom Lens	3x Optical 2x Digital	3x Optical 2x Digital	3x Optical 2x Digital	none	3x Optical	2x Digital	none
LCD Screen	2-inch	2-inch	2-inch	2-inch	2-inch	1.8-inch	none
Video Out	yes	yes	yes	yes	yes	yes	no
Dimensions (HxWxD) inches	2x6.125 x3.75	4.6x2.2 x2.2	3x6.2 x1.4	2.6x5 x1.8	2.5x5.3 x1.3	3.25x4.875 x1.375	
Weight	13.3 oz	1.2 lbs	12.7 oz	8.6 oz	10 oz	8 oz	xxx
Special Features	46mm Threaded Mount; Multi-Language Interface Swivel; Ni-MH Batteries & Charger	IrDA; USB; Flash Sync; Burst Capture; Timelapse; Audio Cap; Scripting; Rangefinder	Burst Capture (low-res); Swivel Rangefinder; (low-res); Threaded Mount	Burst Capture (low-res); 2x fixed zoom Charger; Rangefinder	Audio Capture; Swivel; Ni-MH Batteries & White Balance Earphone jack; Non-Compress Mode	Swivel; earphone jack; Audio Capture; Manual Settings; Non-Compress Mode; Remote Control (optional); Rangefinder	Audio Capture
Software	LivePix SE; Photowise	PageMill; PhotoDeluxe; PictureEasy	PhotoDeluxe; Slides/Sounds; FotoNation; Power Show; LogoMotion	PhotoDeluxe; Slides/Sounds; Panorama	PhotoSudio; PhotoBase; QuickStitch 360	ImageExpert	LivePix SE; PhotoVista
Price	$899	$999	$899	$699	$599	$599	$499
Verdict	9	10 Kick Ass	7	7	8	6	2

*CCD Resolution

So What Should I Buy?

As always, we have to follow the editor's choice Kick Ass award and go with Kodak's versatile and capable **DC260**. This camera has just about everything we want in a digital camera. If the store was all sold out of DC260s, we wouldn't hesitate to buy the Agfa **ePhoto1680**. Great image quality combines with intuitive use to make for a digital camera that fully satisfies.

If price is a major consideration, we wouldn't even consider Vivitar's **3100**. Suffering through its complete lack of features is just not worth the $100 you save. Instead, the Ricoh **RDC-4300** is a much better choice.

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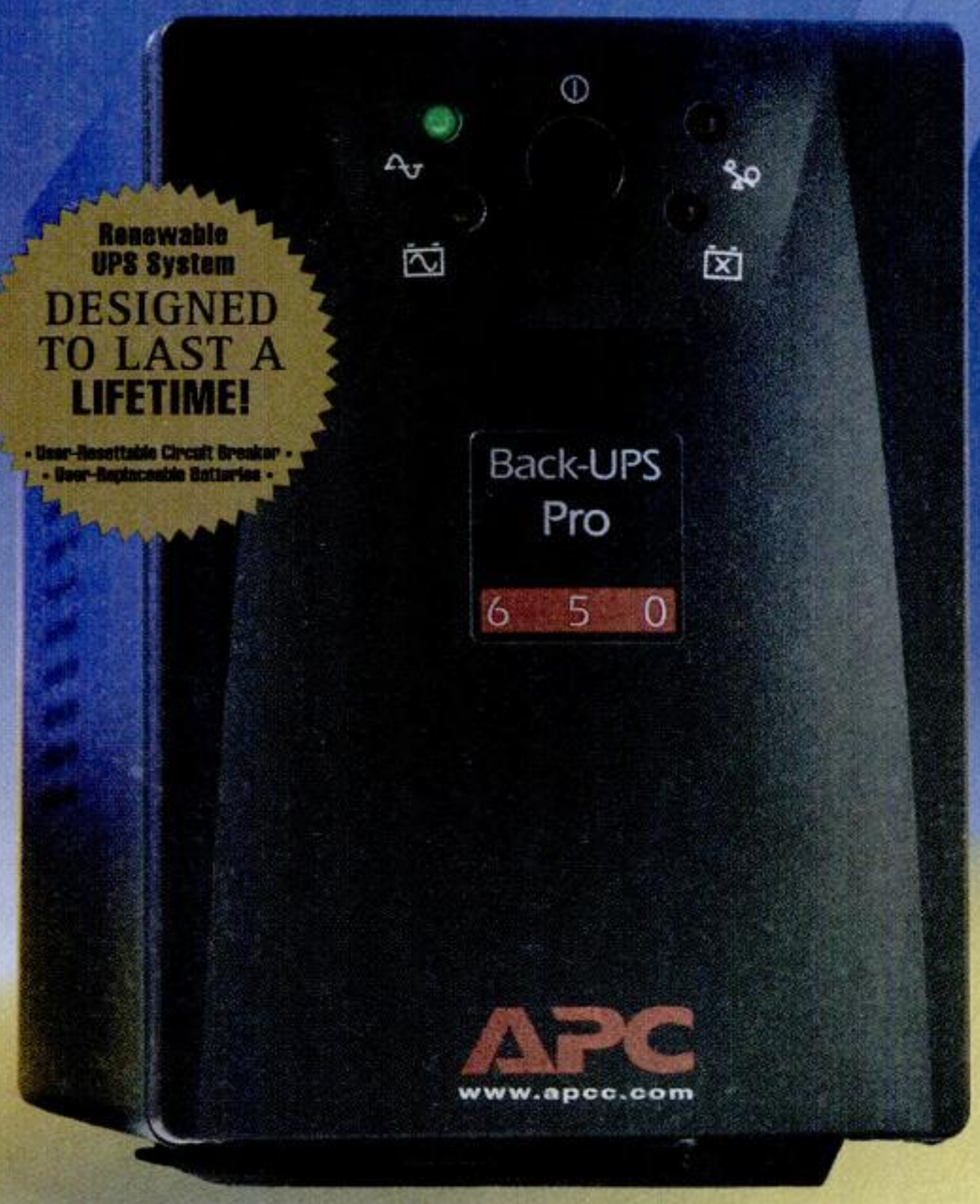
Nothing Lasts Longer



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PC Computing

'Long Lasting'
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The leading cause of data loss: Sags

Power sags are the single largest reason power users end up pulling out their hair over lost data. These undervoltages are easily corrected through APC Back-UPS Pro's Automatic Voltage Regulation and instantaneous battery backup. Of course, if the sags turns into a complete outage, you're still covered: APC's software will automatically save open files and safely shut down your computer, even if you're not at your desk. So why redo a hard day's work when you can prevent the problem with APC?

APC Back-UPS, Back-UPS Office, Back-UPS Pro, will provide runtime which meets or exceeds that of any same VA UPS for desktop PC applications or your money back. For policy information, visit www.apcc.com

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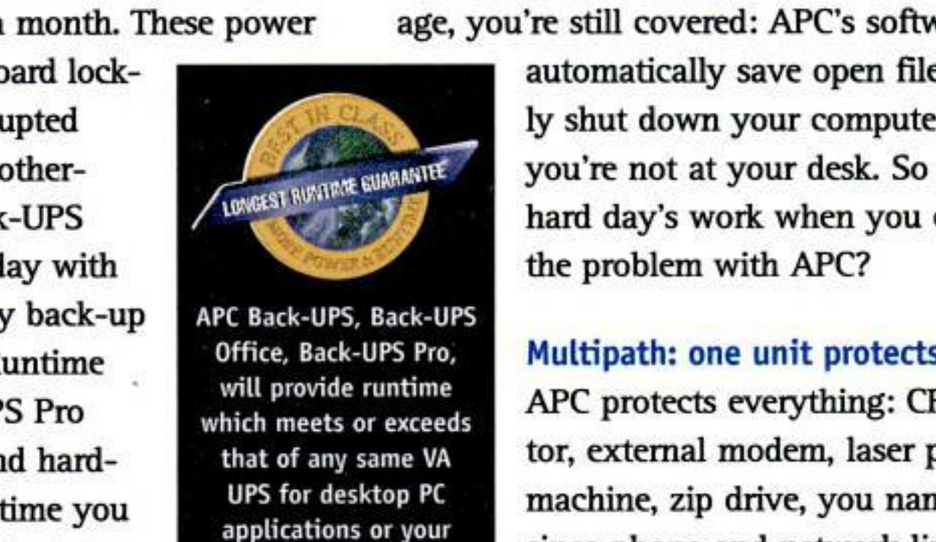
APC protects everything: CPU, monitor, external modem, laser printer, fax machine, zip drive, you name it. And since phone and network lines carry dangerous surges, your CPU and modem benefit from APC Back-UPS Pro telephone/ network surge suppression.



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LAN Connection

BY **SEAN DOWNEY**

Helping two PCs find love in a home network

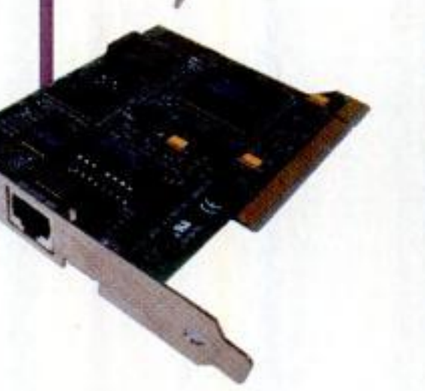
Your PC is lonely. Night after night it hums quietly to itself while shuffling windows, processing polygons, and sorting e-mail. Random encounters across modem lines can't satisfy it anymore. It longs for permanent connections. It wants commitment. So it casts furtive glances at the PC across the hall. Thoughts of hot data-swapping make it jump a clock cycle.

It's time to build a home network. Your love-struck computer can't wait any longer.

There are many advantages to sharing files, games, and gear among all the PCs in your house. No more shuttling floppies from room to room. No more connecting and disconnecting peripherals. No more single-player gaming against lame AI. And with some extra hardware and cabling, you can spread goodwill among all your housemates by sharing out your hard drive and peripherals. We're talking Local Area Networks—LANs, bub—and they're a hell of a lot easier to build than those IS guys at the office would have you believe. On this page, we name all the components you'll need for your home network. Turn to page 68 for more detailed tips, and a look at new home networking technologies that promise to make cabling obsolete. 68 ▶

Network Cards

Network cards are your PC's network ambassadors. Besides physically attaching your PC to a network, the card translates the parallel data stream that's sent across the PC's system bus into the serial data packets required by the network. The network card addresses and breaks into packets the PC's outgoing data before sending it across the wire, and since each card has a unique address, only incoming packets intended for the PC are accepted and unpacked by the network card. While network cards come in several flavors, the most popular are 10/100BaseT Ethernet cards (PCI or notebook Cardbus only, no ISA). These cards automatically detect what speeds the network can handle and adjust themselves accordingly: 10Mbps for standard Ethernet and 100Mbps for Fast Ethernet.



For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

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Hub

All cables on a 10BaseT network lead to a central hub. The hub receives packets and retransmits them to all attached PCs. Like network cards, hubs come in standard and Fast Ethernet flavors. More expensive switching hubs allow both 10BaseT and 100BaseT protocols to be used on the same network.

PHOTOGRAPHY BY AARON LAUER

Printers

The most popular shared peripheral on a peer-to-peer network is the printer. Instead of walking down the hall with a floppy in hand when you need a hard copy, you can just send it across the wire to the PC with the printer, which queues up print jobs and spools them out page by page.

Cabling

With a fatter head and twice as many wires, twisted-pair (or 10BaseT) network cabling is becoming almost as common as standard telephone cabling, its lookalike cousin. Since it's cheap and easy to use, it's the cabling of choice in most corporate networks. The drawback for the home LAN builder is that 10BaseT cabling requires a hub. While thin coax network cabling (10Base2) allows you to build a network without a hub, it also limits the network to standard Ethernet speeds (10Mbps). You'll need Category 5 twisted-pair cabling and a 100BaseT hub to run Fast Ethernet on your network.

Software

Windows 95/98 makes it easy to build a home LAN—client software and major networking protocols are built into the OS. On a Windows peer-to-peer network, sharing out your hard drive or printer is as simple as changing your screen resolution. Through pull-down menus you can give anyone on the network full access to your hardware, or if you want to prevent unwanted access, you can set a password. When another PC on the LAN uses your hard drive or printer, the OS uses service redirectors to trick applications into thinking your gear is physically attached to the PC.

TIP: Enabling File and Print Services allows you to give others access to your directories and files across a Windows peer-to-peer network.

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LAN Connection

Thoughtful Courtship

Before laying down cable, decide whether you want a cheap-and-dirty LAN for multiplayer *Quake II* fragging or a state-of-the-art 100Mb network with limitless bandwidth. If you go state-of-the-art, be prepared to spend big bucks for the requisite hardware: Category 5 (CAT-5) twisted-pair cabling runs about $6 for every 10 feet, 10/100BaseT PCI Ethernet cards cost $50 a pop, and a four-port Fast Ethernet hub costs between $100 and $200. If you decide to go with a cheap LAN and work your way up, make sure you start with 10/100BaseT Ethernet cards and CAT-5 cabling so you won't have to retrofit key parts when you graduate from a 10BaseT hub to a 100BaseT hub (while the price differences between 10- and 100BaseT network cards are insignificant, the disparity in hub prices can bite you on the ass).

TIP: If you're building a Fast Ethernet network, make sure to enable full-duplex mode on the network card in order to get 100Mb transfer rates.

You also need to consider the eyesore of foot-tripping wires snaking around your house. Network cables can be easily hidden when connecting two PCs in the same room, but it's difficult to make room-to-room cabling pretty without calling an electrician. A hole in the wall will always be ugly no matter how much putty you pack into it. The type of cabling you use can also affect your network card and hub options, as well as the physical shape of the network itself. For example, the thin coax daisy-chained strands of a 10Base2 LAN demand a more complex wiring arrangement than a 10/100BaseT twisted-pair LAN, which routes each network strand through a central hub.

After selecting cabling, you'll need to install a network card in every PC you plan to connect. PCI and PC cards install easily, but if you're using an old ISA card you may be in for an IRQ shuffling match. Non-plug-and-play ISA cards usually have a utility for configuring system resources. But if they don't have this utility and if Windows doesn't like the card's settings, you'll have serious problems. (If the name of the card appears in Windows Device Manager without an exclamation point or red X in front of it, you're on your way.)

When Win95/98 sets up your card, it also installs basic networking components, which can be viewed and configured through the Network Control Panel. Two protocols—NetBEUI and IPX/SPX—are automatically installed by Windows, and Client for Microsoft Networks is the default network requestor. You need not remove any of these components from your Network Control Panel. To enable resource sharing across your LAN, go to the Control Panel and click on the File and Print Sharing button to select what you'd like to put out on the network. (You'll need the File and Print Sharing service component. If it's not already installed, add it from the Control Panel.)

All the computers on a single LAN must be part of the same Workgroup in order to see each other. This information is set up through the Identification section of the Network Control Panel. Along with unique computer names and

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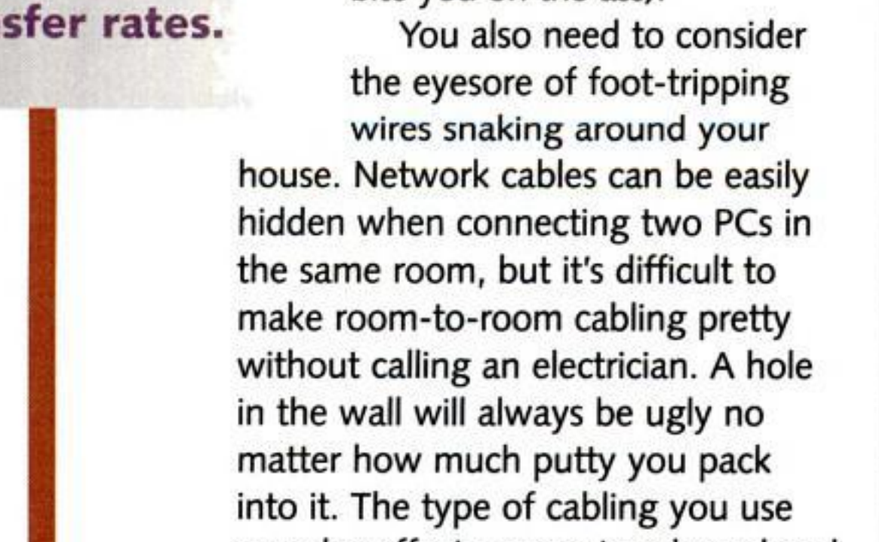
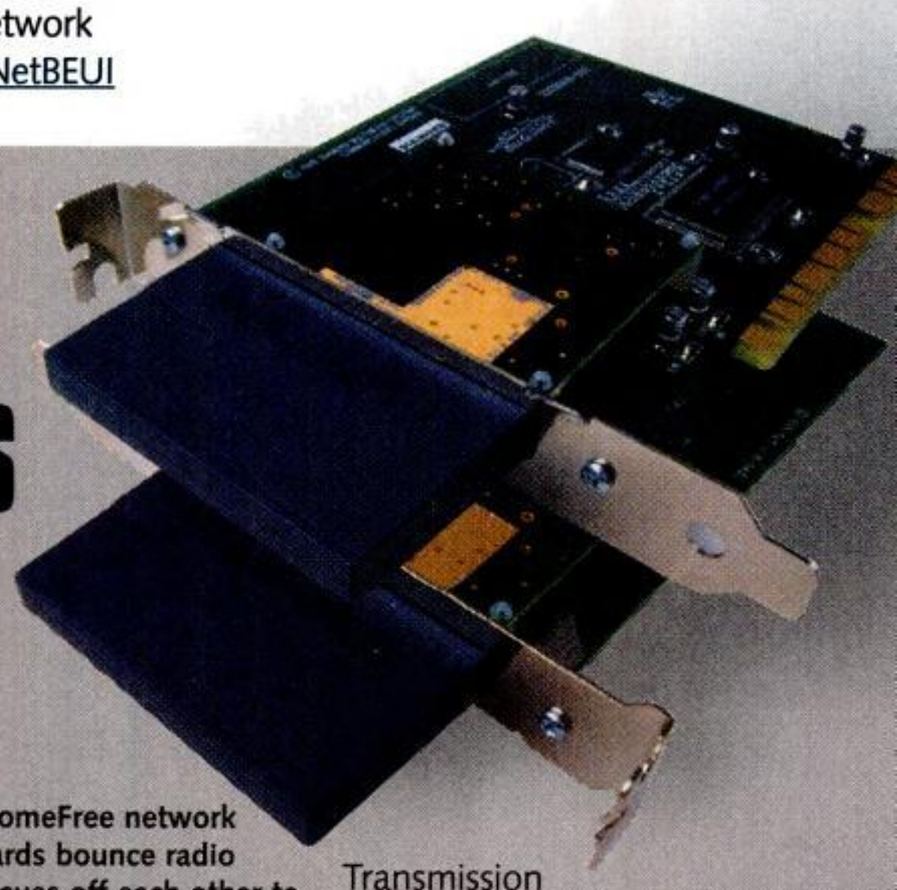


This card has both a BNC connector for thin coax and an RJ-45 connector for twisted pair.

Futuristic LANscapes

If you're interested in a home LAN but find the prospect of laying cable throughout your house disconcerting, you may want to go wireless or build your LAN through your existing household wiring. Three innovative signal-transmission techniques are making their way into networking kits and taking cables out of the home networking equation.



HomeFree network cards bounce radio waves off each other to create a cable-free LAN.

Diamond HomeFree

Diamond's HomeFree networking kits use high-frequency radio waves to connect your PCs in a truly wireless LAN. A radiotransmitter/receiver with a range of 150 feet is mounted on the back of each HomeFree network card. The cards work similarly to 900MHz cordless phones, transmitting network packets in the relatively free 2.4GHz range and switching across 83 channels to ensure the LAN's security. Transmission speeds hover around 1Mbps. A constantly readjusting signal fosters reliability.

HomeFree's radio signals travel through floors, walls, and ceilings, and promise very little interference from cordless phones, microwaves, or radio-controlled cars. The system autoconfigures, so to add a new PC to the LAN, you simply install the card and load the software. The software bundle includes modem routing software for multiple-user Internet access across the LAN. Two HomeFree networking kits are available from Diamond Multimedia (**www.diamondmm.com**): the Desktop Pac ($200) comes with one ISA card and one PCI card; the notebook Combo Pac ($230) comes with one ISA and one PC card.

70 ▶

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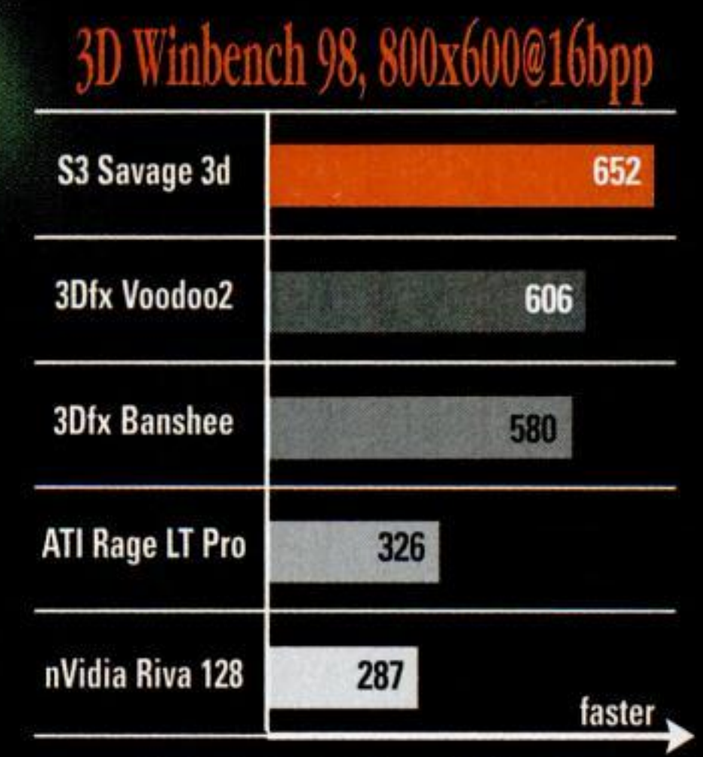

Source: Ziff Davis, PC PROFESSIONELL 8/98

Hercules

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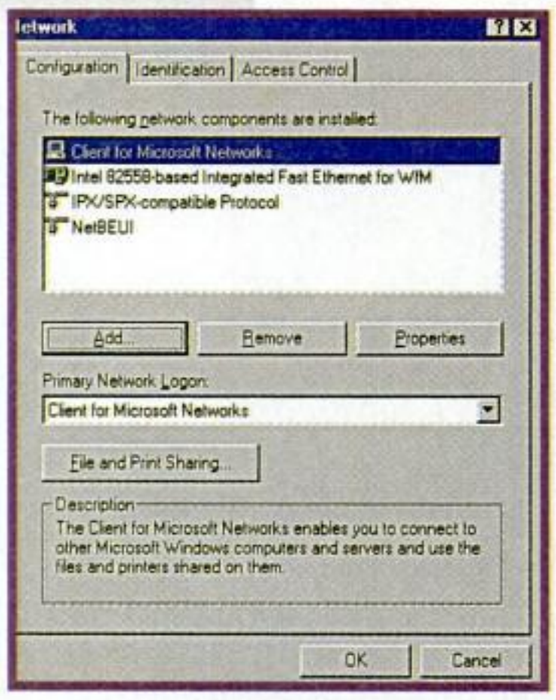
LAN Connection

descriptions, each PC should have the same workgroup name entered in this section.

To share files in Win95/98, go to the sharing option in the context menu of each hardware device and directory you want to share. For example, if you want to share your Downloads directory, right-click on the directory icon in Explorer, turn on sharing in the properties window, and give it a share name. Now when someone browses the Network Neighborhood for shared resources, he'll find all the devices and directories offered by your PC. Network users can also easily map the shared directory to a drive letter by right-clicking on it and choosing Map Network Drive.



The Identification tab of the Network Control Panel is where you enter the information Windows uses to identify you across network. The Workgroup specifies who you share resources with.

If you're looking to hook up housemates to a single ISDN line, you're going to need more than Win95/98. While Windows makes it easy to set up shared printers on networked PCs through the Add Printer Wizard, it doesn't provide the same convenience for shared modems. For this you'll need to install software such as Deerfield Communications' *WinGate 2.1 Lite*, or Ositis Software's *WinProxy Lite*. You'll also want to install the TCP/IP networking protocol on each PC that's going to share an Internet connection across the LAN. The software will include instructions on setting up the IP addressing.

The modem-sharing software routes Internet access requests from other PCs through a software proxy on the PC that's connected to the modem. This allows several people to use the modem at the same time. But be forewarned: Multiple users on the same modem makes for a slower Internet experience.

A well-built LAN will change the way you use your PCs at home. You'll benefit by saving time when printing and sharing files, and save money on duplicate peripherals and Internet access. And you'll also make your PC a little less lonely. ✹

Intelogis PassPort

Intelogis's PassPort takes a nonintrusive approach to LAN building with a simple networking adapter, appropriately called a PC Plug-In, that connects to your PC's parallel port and plugs into a power outlet. Network signals are transmitted through your home's electrical wiring at 350Kbps and are picked up by another PassPort adapter in another wall outlet. PassPort's transmission speeds are definitely on the slow side compared to Fast Ethernet's 100Mbps, but speed isn't the main strength of the PassPort, since it sells itself mainly on the ability to create an insta-LAN with just a couple of wall outlets.

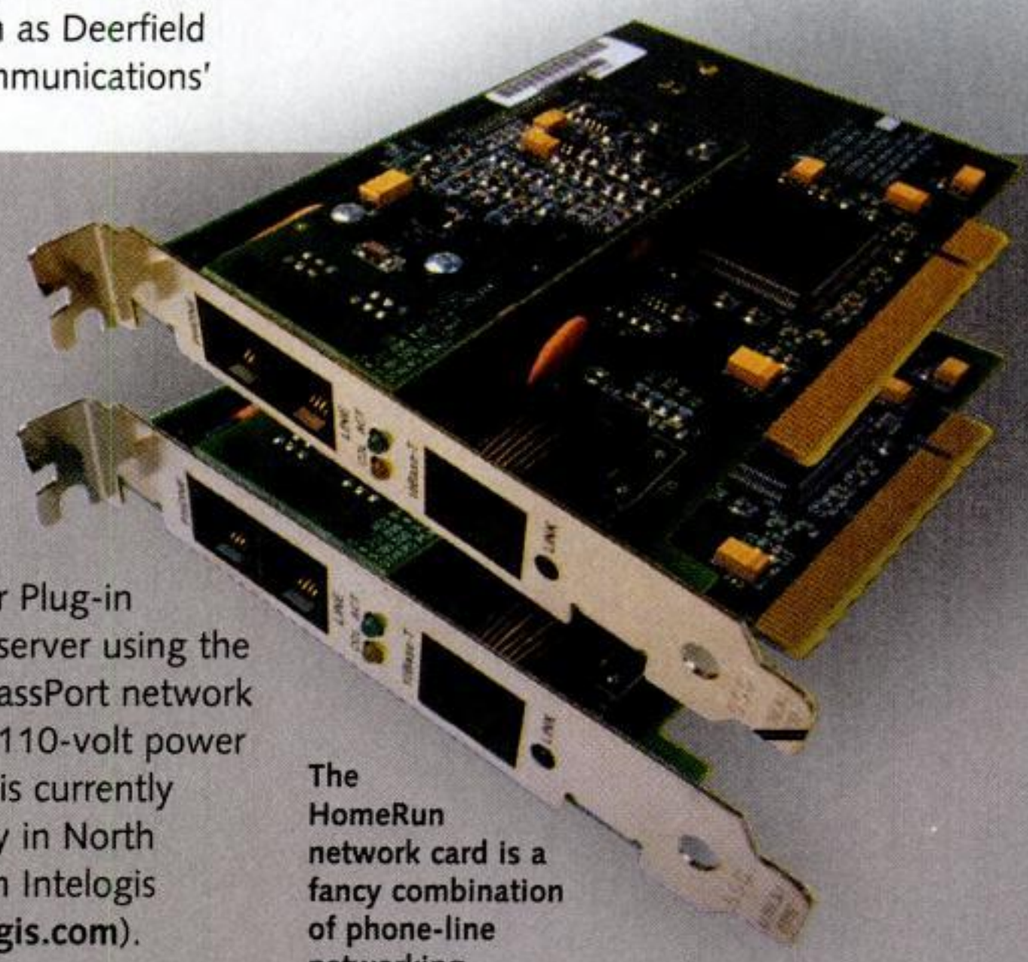
The PassPort Plug-in Network kit costs $250 and includes two PC adapters and a Printer Plug-in that works as a print server using the same principle. The PassPort network is spec'd for 110-volt power systems and is currently available only in North America from Intelogis (**www.intelogis.com**).

TIP: Make sure you've chosen what you want to share under File and Print Sharing in the Network Control Panel or nobody will see your printer or connect to your shares.

The Passport Plug-In takes a lot of the fuss out of networking by building a LAN through parallel ports and electrical outlets.

Tut HomeRun Network Card

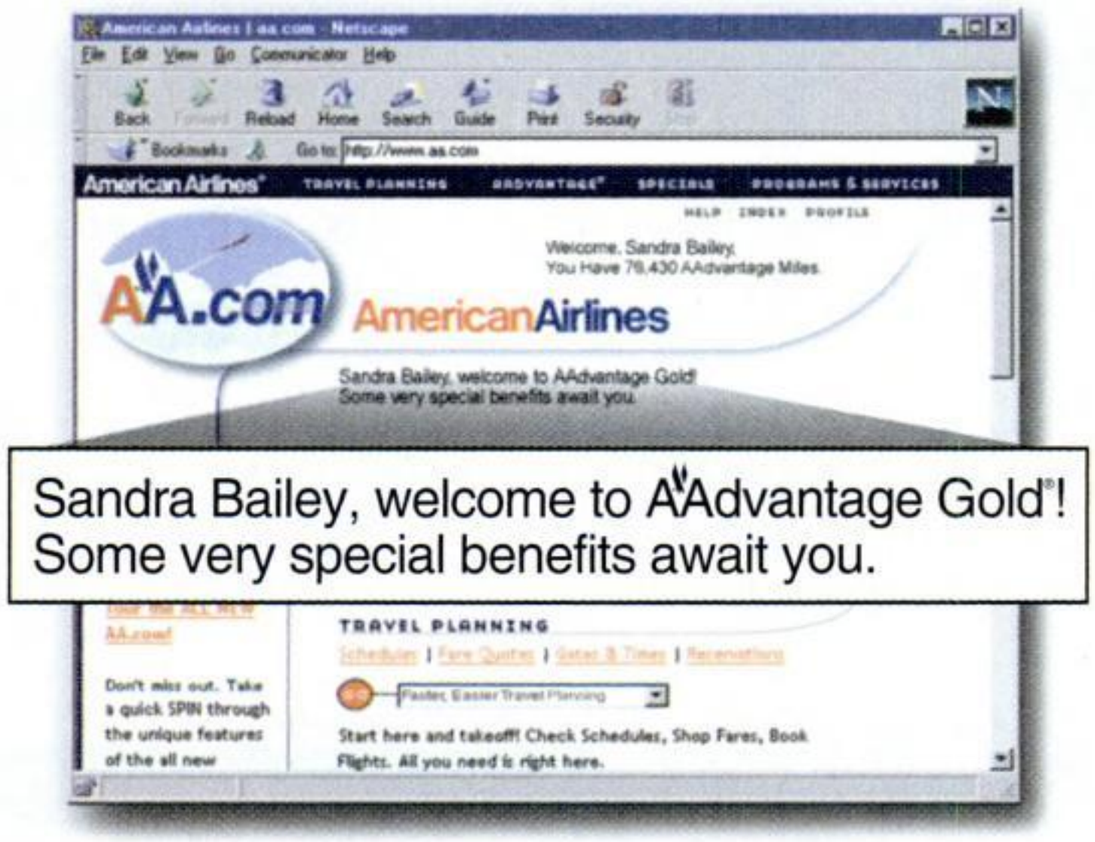
Tut's HomeRun network cards piggyback network packets across the existing phone lines to create a 1Mbps home LAN that doesn't interfere with regular phone traffic. Once the PCI cards are installed, you simply connect them to standard RJ-11 wall jacks, and your HomeRun LAN is ready. The cool thing about the HomeRun cards is that they also function as Ethernet adapters, so you can hook them up to your 10BaseT LAN to extend it to places you couldn't wire yourself. For example, you can route data packets from the 10BaseT to HomeRun signals on the same card and connect your downstairs PC to the LAN upstairs.



The HomeRun network card is a fancy combination of phone-line networking technology and 10BaseT Ethernet compatibility.

While Tut (**www.tutsys.com**) will be selling its own adapters, other companies will be bringing the technology to consumer stores in networking kits. Pricing for a HomeRun adapter hasn't been announced, but Tut is targeting the $100 price range. ✹

How do we love thee?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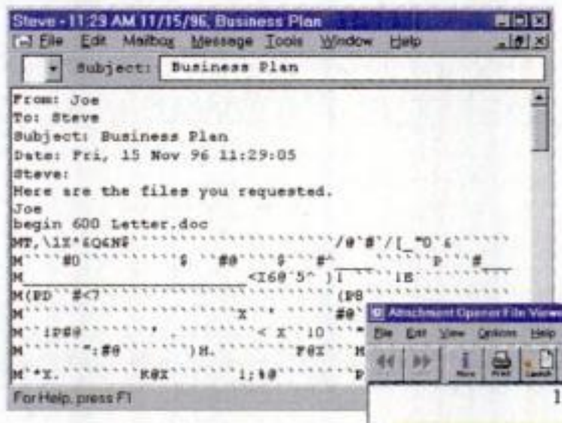

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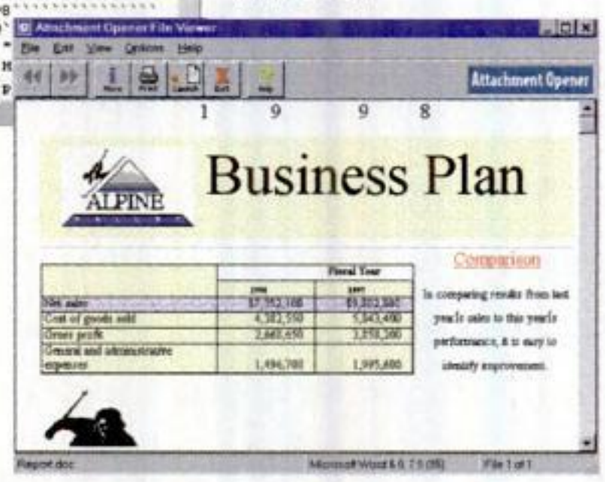

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10-Year-Old Sound Problem

I'm a concerned 10-year-old webmaster (yes, a 10-year-old webmaster). Whenever I turn on my computer, it doesn't play any sounds! Someone told me to take apart the computer, but I'm only 10! I have an Aztech Sound Galaxy Washington 16 soundcard in a Packard Bell computer with Windows 95. Help!

—Tim Bornholdt

The Doctor's cubicle mate once started screaming about his sound being disabled. He took apart the computer and ranted as he pushed and pulled cards. Then he realized he turned off his speakers. As basic as it sounds, it happens. I recommend you check the speaker connections first. Run the speakers on a Walkman to see if the wires and connectors are good. Then right-mouse-click on My Computer, properties, and device manager. Look for an exclamation mark in your sound, video, and game controllers section. If there is a yellow mark, the soundcard may be conflicting with a piece of hardware you installed recently. It sounds like you haven't opened the case, so I assume it could be external hardware. You may also want to download and install the latest soundcard drivers from your manufacturer's site. And, of course, double-click on the speaker icon in the system tray and make sure nothing is muted and the volume settings are cranked up. Try to isolate what type of sound it won't play. Will it play CDs, but not WAV files? If it plays CDs but not sound files, there's a greater chance it's a device or driver conflict than busted wires.

Shutdown Problems

I caved in to all the hype and bought the Windows 98 upgrade. It loaded without incident, but now whenever I shutdown the machine I get a screen with the error message "MSGRV32 - An error has occurred in your program. To keep working anyway click ignore and save your work as a new file. To quit, click close." If I click ignore, nothing happens. Eventually I get to an error message that says: "MSGRV32 caused a general protection fault in module CM8330SB.DRV."

I already tried giving it the three-finger salute and sequentially closing the four programs it lists as being open ("Instant Access OCR," "Explorer," "Sortdemo," and "Systray."). It doesn't matter because they'll be back when I reboot.

—Vern Weiss

"I caved and bought Windows 98. Now whenever I shutdown the machine I get a screen with the error message 'MSGRV32'."

The Doctor believes your symptoms are the result of a driver conflict between your C-Media-based soundcard made by C-Media Electronics and Windows 98. Downloading the latest CMI8330 driver from **www.cmedia.com.tw** and installing should fix your problem. The driver update also fixes problems with joysticks and stand-by problems.

Voodoo You Do in a Window

You said in a previous issue that Voodoo can't do windowed 3D graphics. Voodoo cards can run in a window using Nullsoft's *WinGlide*. Check out **www.nullsoft.com**. They're the same people who make the great MP3/WAV player, *WinAmp*.

—Steve Hawkins

The Doctor The No Prize is in the mail, Steve.

Sluggish Performance

I'm running Windows 98 on a home-built 133MHz Pentium with a VX chipset, 512KB cache, and 24MB of Fast Page Mode RAM. I upgraded from my PCI 50MHz 486 DX2 and am still using the older 2MB ET4000-based videocard. I've recently noticed that my system has been slowing down.

Whenever I surf the net using either *Communicator 4.5 PR1* or *Internet Explorer* with two or more windows open, the system is sluggish. For example, when I try to maximize a window, it'll show it bit by bit and my hard disk churns away like crazy. Normally this would mean not enough memory, but I have 24MB! What do you suggest I do?

If you do suggest that I get more RAM, how much should I get? The Intel VX can cache only up to 64MB, but do you think getting 128MB is better?

—Eric Lai

The Doctor With the thrashing Windows 98 is giving your hard drive, it sounds like you're getting a lot of caching. The minimum recommended RAM for Windows 98 is 16MB, but don't believe it. You'll need at least

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32MB of RAM for reasonable performance in Windows 98. Since the price of Fast Page Mode RAM is so low, you can probably trade an old 5.25-inch floppy drive for 16MB. Go long if you can and get 64MB. It'll end up being worthless in the end, but the cost-to-performance will be worth it. Using more RAM than the chipset can cache is not recommended, unless you run applications that are severely RAM intensive.

Bypassing IE Security

I've been trying to figure out how to bypass the content advisor inside the Internet applet in Control Panel, but can't seem to find out how. I'm assuming it would be in the registry, but I haven't found it. And Microsoft hasn't responded with an answer to the question.

—Rob

The Doctor Sure you're not some kid who wants to get past the content advisor mommy set? I recommend you do this only if you're comfortable hacking your registry, which you should of course back up first. Go to Start, Run REGEDIT. Once it's started, go to Hkey_Local_Machine\Software\Microsoft\Windows\CurrentVersion\Policies\Ratings. Delete the entry called "key." That should clear up the password under both *Internet Explorer 3.0* and *4.01* in Windows 95.

Monster Rush Conflicts

Doc, I've had an Intense 3D Voodoo Rush board for some time now. Games such as *GLQuake* and *Quake II* always ran fine on it. However, after recently buying a Monster 3D 2, I noticed that the two *Quake*-based games still use the Rush board to render OpenGL. How can I get games like these to recognize the new card?

—Don Mosites

The Doctor Uh oh...sounds like you're encountering a Glide misunderstanding. With your Voodoo Rush board, you had to use a Voodoo Rush–specific version of Glide, 2.45. Voodoo^2 uses a newer version of Glide (2.5) for its functionality. When you originally installed Glide v2.45, it installed for your Rush board. Under normal circumstances, when you installed your Voodoo^2 card, it should have installed the latest version of Glide and made the appropriate changes to your registry and settings.

It sounds like it didn't. This will be tough, because Glide 2.45 for the Voodoo Rush is not compatible with Voodoo^2—that's the reason for the newer version. The only thing I can think of is to re-install your games, then re-install your Voodoo^2 card. Having those two boards battling it out for Glide privileges is not a good thing—you may want to think about chucking that Rush board if that's a possibility and just go with a sweet 2D card.

Blow Hard

This is a stupid question, but someone has to ask it. I'm building another PC and the new case came equipped with three built-in fans. The odd thing is that they use very small connectors with only two holes in them, and I have no idea how to plug them into the power supply. I really would like to find out so I can overclock this thing.

—Zachary Burka

The Doctor The connectors should plug directly into your motherboard. You should see several pin-outs on your motherboard labeled for fans. Your motherboard may not support them.

"I've heard that the ALi Super TX chipset is different from the Intel TX chipset. Can I go over 64MB of RAM without a loss in performance?

Illegal Installs

When I try to install the SR-1 version of *Microsoft Office 97 Professional*, I get an error that ACMSETUP has caused an illegal operation with the module KERNEL32.DLL. This is under both Windows 98 and the OSR 2.1 version of Windows 95.

—Elmo Beans

The Doctor According to Microsoft, enabling DMA support for CD-ROMs can cause problems with ACMSETUP when installing *Office*, *Project 98*, or *Works* 4.0 and up. The workaround is to disable DMA support by right-clicking My Computer, Properties, Device Manager, CD-ROM. Double click on the drive, pick Settings, uncheck the DMA box, click OK, and reboot.

Annoying Pauses Revisited

Richard Chiu complained of three short pauses every few minutes when playing games (September 1998). I have seen the same thing and have fixed it by giving my machine an IP address. It seems that if you don't, Win95 and 98 want to go out and try to find one for you every few minutes.

—Doug Dodson

No 2D for Me

Doc, I took the advice of another magazine and sold my i740 videocard to buy a Voodoo^2 3D card. Now I can't get my computer to work. I don't know what's wrong.

—Mike S.

The Doctor Your problem probably stems from the lack of a primary 2D videocard. While the Voodoo^2 is a great gaming card, it doesn't do 2D at all. Period. I don't know what rag gave you that info, but they made a big gaffe.

You'll have to hock your PlayStation to buy another videocard, bub.

Maximum RAM

I've heard that the ALi Super TX chipset is different from the Intel TX chipset. Are these the same chips? And can I go over 64MB of RAM (planning to add 64MB for 96MB of gaming goodness) without a loss in performance?

—John P. Kooistra

The Doctor Slap me with a fish. Since my reply to a reader about his sluggish system response with more than 64MB of RAM (September 1998), I've gotten a slew of letters from sharp readers pointing out my slight boo-boo. Due to limitations in the TX chipset, it is able to cache only a piddling 64MB of RAM. Add more than that and no RAM is cached. While The Doctor knew this fact, it slipped the Doc's mind. I invite sharp readers to write in with corrections, further insight, and to qualify for a No Prize.

Vendors "cloned" Intel's 430 line of chipsets. If you're not having problems, that's great. The Doctor has frankly heard too many anecdotal incidents or problems with the TX clones to recommend them, though.

Miscellany

Readers report that Justin Thompson's problem with being stuck in DOS-compatability mode may stem from the presence of a boot sector virus, particularly the Stealth Boot_B virus. Others advise that removing the NOIDE entry in Hkey_Local_ Machine\System\CurrentControlSet\Services\VxD\IOS and rebooting may help. Obviously, not every answer will work for you. Finally, another reader advises that a shorted power cable on a 3.5-inch drive can cause an ATX power supply to appear dead.

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Vortex 2 and A3D 2.0

Aureal's ambitious gamble

In graphics, raytracing is the ultimate tool for creating laser-sharp 3D worlds. Now Aureal, a company working hard to raise the bar in soundcards, aims to bring the same level of precision for rendering sound on your PC with its "wave tracing" technology in A3D 2.0.

Wave tracing literally builds worlds based on the same principles as raytracing's method of following light rays and reflections to create ultra-real 3D objects.

Aureal's wave-tracing model calls for creating an audio duplicate of a 3D environment such as a room with corridors, walls, and objects. Your position in that room is also plotted. Sounds are then rendered and reflected based on how close you are to a wall, what material it's made of, and the distance from you to the object or objects making noise.

What does this mean to you?

Theoretically, you'll get a much more immersive environment because of the more precise sounds. Shimmy into a wooden alcove, and the sound qualities and geometry will shift to match your setting and the position of your head.

To further the realism, Aureal has implemented occlusion in A3D 2.0, or the ability to give sound a blocked property. No longer will a party or a creature's breathing in the next room sound like it's in your room. Instead, it can sound highly muffled as it passes through a stone wall or thrum through three or four walls made of wood.

Until we see titles that scale up to use the amount of 3D sound channels, it's just marketing hype.

If this all sounds complex, it is. What happens when you factor in wave tracing, occlusion, and your normal HRTF algorithms to five moving objects in a room? There are enough calculations to bog down a boxcar of moldy old Sound Blaster Pros. To accomplish the task, Aureal minted the Vortex 2 AU8830. With 3.3 million transistors, the Vortex 2 packs more complexity than even Creative Labs' vaunted E-Mu 10K1, which has two million transistors pumping life into the Sound Blaster Live!.

TRANSISTORS APLENTY

The Vortex 2 also ups the ante in the DirectSound3D streams it can accelerate. While most

AUREAL AND DIAMOND MULTIMEDIA GO TAG TEAM

Reaching for the purple and orange Sound Blaster Live! box in aisle 51 at your local computer store? Diamond Multimedia and new tag-teammate Aureal want you to instead consider the green and red Diamond box with a Monster Sound MX300 waiting inside.

While we hadn't seen an MX300 at press time, its feature checklist got us hot enough to look away from the packed Sound Blaster Live! card for a moment. Consider the wave-tracing technology and quad-speaker support, and then factor in the AC-3 or Digital Dolby virtualization down to two or four speakers. Toss in a suite of MPEG-3 applications and we had to have a drink of cold water to calm down.

But there's some bad news for budget shoppers waiting for no-name Vortex 2 clones to hit the shelf at $29. Aureal has signed exclusive deals with five vendors around the world to use the Vortex 2. The U.S. market will see Diamond and Turtle Beach pumping out Vortex 2s, with Diamond apparently out to capture the marketing spotlight early.

Creative Labs isn't sitting on its hands, though. Although the features are mostly meaningless with the current generation of games, Creative said it will quadruple the number of DirectSound3D streams from 8 to 32 in hardware. The Vortex 2 currently supports 16, but in response to Creative's announcement of 32 streams, now says the Vortex 2 can max with 76 DirectSound3D streams. The Live! will also eventually support AC-3 decoding as well. Until we see titles that scale up to use the amount of 3D sound channels, it's just marketing hype.

Diamond has priced the MX300 at a competitive $99. With Creative Lab's Sound Blaster Live! Value Edition, basically the Live! without the fancy-schmancy digital I/O connectors, coming in at $99, you'll spend a long time fidgeting in the aisle.

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

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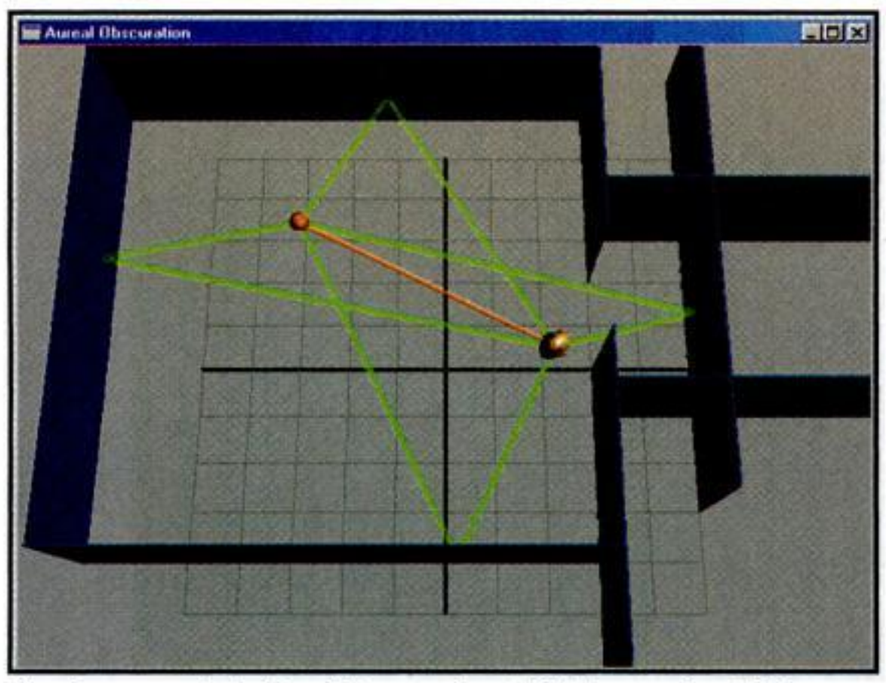
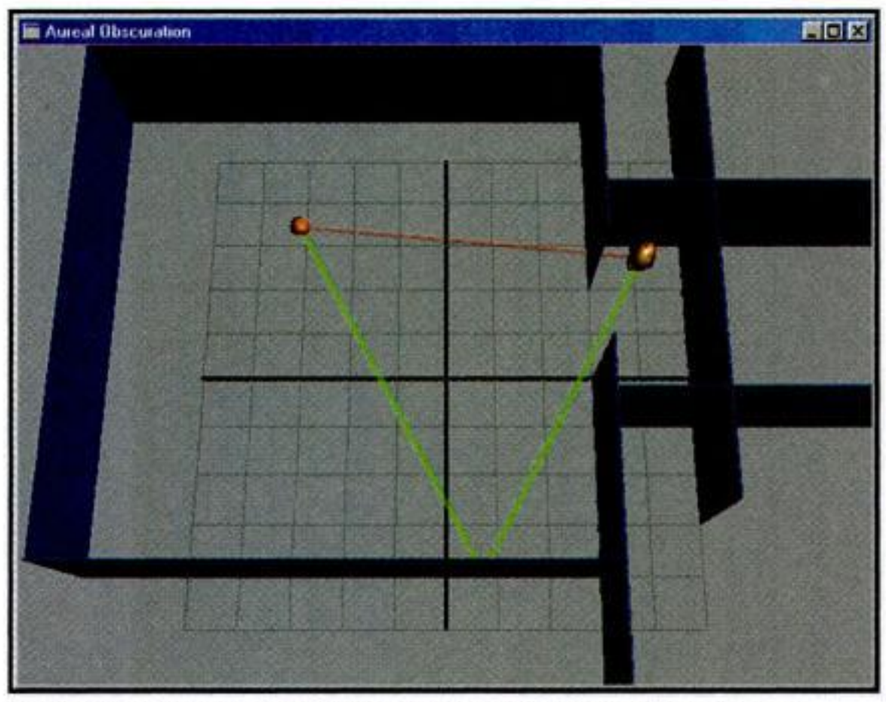
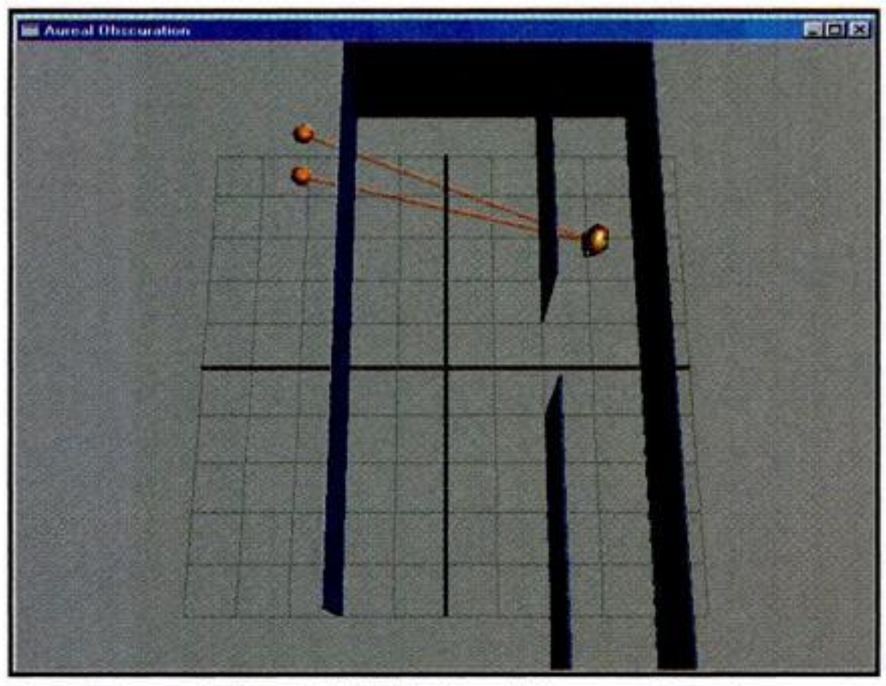


The lumpy potato-like thing on the right is your head. The green lines represent the reflection calculations the Vortex 2 makes to render sound.



Move your potato into this corner and the reflections and geometry correct for your position and use the correct amount of occlusion.



Turn that music down! With both walls' properties set as "carpet," the thumping music sounds just like your real neighbors on Saturday night.

of the current soundcard pack—except for Creative's Live! card—will accelerate up to eight DirectSound3D streams, the Vortex 2 will accelerate 16, along with 64 reflections and a maximum of 96 PCI audio streams. Aureal says 76 DirectSound3D streams can be supported in hardware. And the Vortex 2 improves over the previous Vortex by doubling the number of wavetable channels in hardware to 64. Vortex 2–based cards will also process audio at 48kHz at up to 24 bits.

Although Aureal has always been noted for its effectiveness over two speakers with its HRTF routines, quad speaker support is the buzzword today. All Vortex 2 cards will now support four speakers. While previous incarnations of the Monster Sound supported quad output in A3D 1.0, listeners lost the ability to discern elevation changes with sound. Aureal has addressed that limitation in A3 2.0 with Super Quad, which will let you hear an object pass above or below your horizon. The preview board, however, lacked the quad codec hardware, so we were unable to test this ability.

Older Vortex 1 cards will get a facelift with A3D 2.0, picking up occlusion in the deal, but will still lack support for wave tracing. Aureal will also get picky with emulation modes, which its competitors are using to steal Aureal's thunder. Previously, non-Aureal approved soundcard drivers would capture the A3D calls and shunt them to DirectSound3D. Fire up an A3D game on a non-A3D card and it would say it has A3D-approved hardware. No more. Aureal, saying its competitors' attempts at flattery muddy its good name, will check hardware to ensure it's truly A3D compliant.

SUPPORT ISSUES

The question that must be answered in order for wave tracing to succeed is how much title support Aureal will generate. As Aureal's detractors say, it's just too complex a model for developers to devote time and resources to for them to support just one chip. Some developers disagree, however, saying Aureal does what a technology company should do by pushing the envelope for both hardware and software.

Aureal argues its precise model is much more effective than Creative's Environmental Audio (EAX), which uses a reverberation-effects engine to enhance the sound of environments. In its first implementation of EAX, Creative has chosen the path of least resistance, letting developers choose to simply add the properties of a room by selecting "small metal tube" or "stone room." EAX support can be and has been added to games in a matter of days, Creative says.

But Aureal is doing what it can to convince developers they should support not just Microsoft's DirectSound3D by creating an API that supports other competitors' chipsets. Aureal says A3D 2.0 lets developers write to a single API that will use Vortex hardware if available, or DirectSound3D in hardware or software. Aureal may even support Creative's EAX.

But how well does it work? The A3D 2.0 demonstrations on a beta Vortex 2 board showed promise. Moving around rooms and stepping into hallways had more subtle transitions than environmental audio. Sound also seemed more like what you would hear walking around an area with many hard surfaces reflecting sound.

A3D 2.0 still needs minor tweaking. At times, sounds abruptly clipped out by just moving a few inches. These aren't fatal flaws considering the state of the preview drivers. What we needed to fully test it, and what weren't available yet, were titles that supported A3D 2.0. Several new games will support A3D 2.0, and Aureal says a number of others are in development.

—Gordon Ung

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Testing Policy

Our product evaluation process is built on down-and-dirty, hands-on testing. All hardware benchmarking is conducted in the Maximum PC lab by Maximum PC editors, and, whenever possible, we use real-world applications to gauge performance. Our final verdicts are based on benchmark results and a subjective appraisal of product features.

Real-World Benchmarking

Our benchmarking charts are simple: The farther right the bar reaches, the better the hardware performed. Here's the deal on specific benchmarks.

► **CPU/MOTHERBOARD** Based on Symantec's System Information benchmark, the bootMark tests the CPU, its bus interface, memory, memory cache, and core-logic chipset. The final benchmark score is based on an arbitrary performance range.

► **WINDOWS APPS** BAPCO's SYSmark98 uses task scripts in popular productivity and content creation apps to test real-world performance. The benchmark also puts major stress on the videocard and driver, forcing it to draw complex screens in rapid succession. The final benchmark score is based on an arbitrary performance range.

► **HARD DRIVE** HD Tach measures multi-threaded hard drive performance. We publish the average 16k read score in megabytes per second.

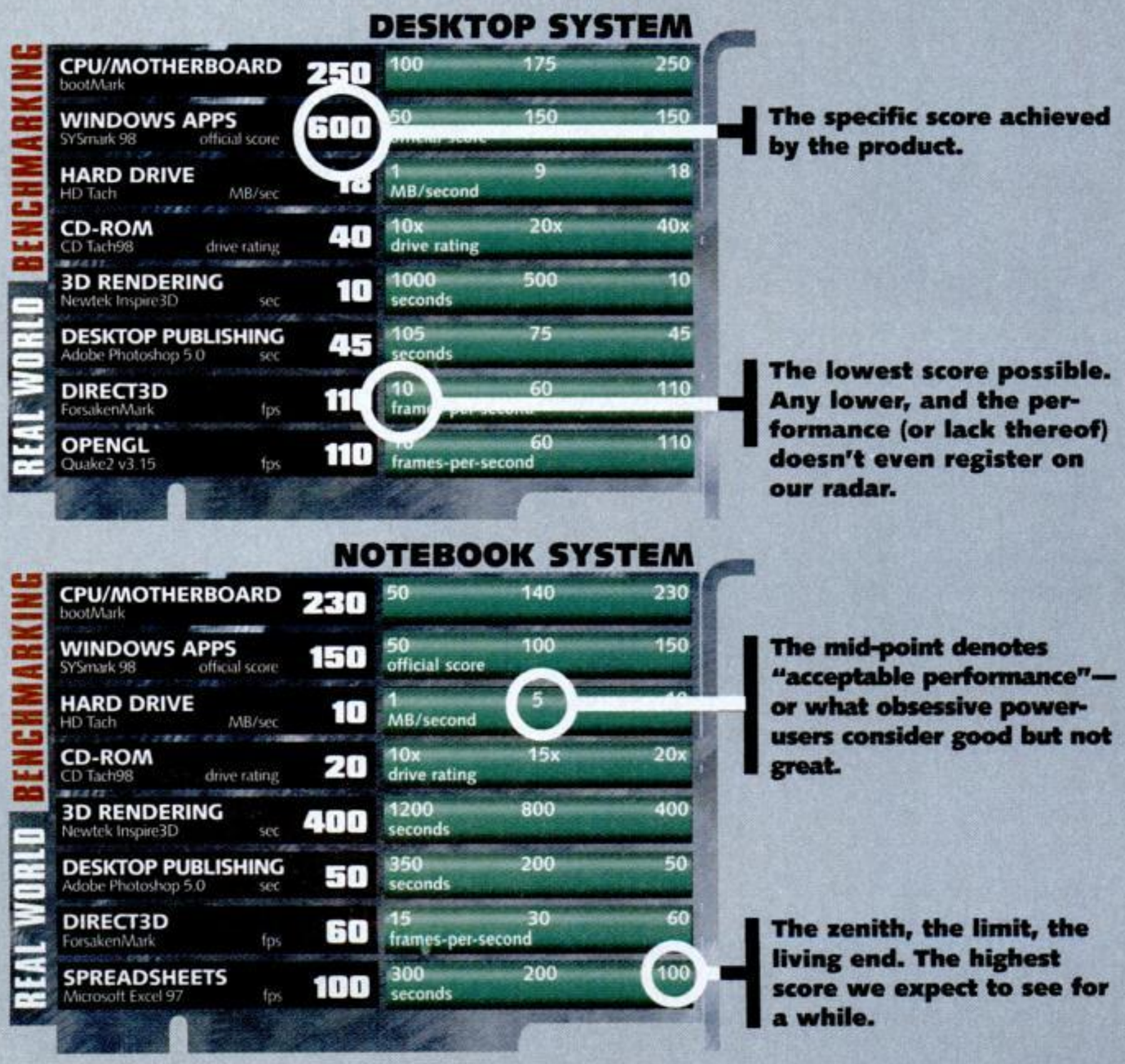
► **CD-ROM** CD Tach measures CD-ROM read times and CPU utilization. We publish the drive's cumulative speed rating (e.g., 24x).

► **3D RENDERING** We use Newtek *Inspire3D* to gauge how fast the machine can complete a complex ray-traced rendering—a grueling test of the CPU's floating-point power. Final score is in total seconds from start to finish.

► **DESKTOP PUBLISHING** In a scripted Adobe *Photoshop 5.0* test, we record how long it takes to apply various filters to a control image. A brutal test of the CPU, memory subsystem, and hard drive. Final score is in total seconds from start to finish.

► **DIRECT3D** *Forsaken* is a space shooter rich in colored lighting, and alpha-blending. Tests the 3D accelerator (and Direct3D drivers), and the CPU's floating-point. Final score is in average frames per second at 800x600. Also used in video card benchmarking.

► **SPREADSHEETS** A notebook-specific benchmark. Using Microsoft Excel, we have the app crunch through a fat spreadsheet, and we time how long it takes for the notebook in question. The faster, the better.



► **BENCHMARKING SYSTEM**

We use a Micron Millennia XRU with 400MHz Pentium II processor, 64MB of SDRAM, Intel 440BX motherboard, and Windows 98 with DirectX 6.0 core to benchmark all of our components.

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▶ **OPENGL** *Quake II* is a first-person shooter rich in complex polygons and all those nifty OpenGL special effects. Tests the 3D accelerator (along with its OpenGL drivers) and the CPU's floating-point. Final score is in average frames per second at 800x600. Also used in video card benchmarking.

▶ **BATTLEZONE** Another effects-intense Direct3D game. For videocard reviews, we run all three of our 3D gaming benchmarks at both 800x600 and 1024x768. Final scores are in average frames per second.

▶ **RAM SPEED** Stream for DOS 2.0 tests motherboard memory bandwidth in megabytes per second.

▶ **AGP PERFORMANCE** Final Reality AGP is a Direct3D benchmark that uses 20MBs worth of textures to tax the motherboard's AGP bus. Final score is in average frames per second.

GUT SHOTS: FULL EXPOSURE, FULL DISCLOSURE
All system reviews feature large open case shots to give you a first-hand look at motherboard accessibility and expansion opportunities. And whenever possible, we show you the guts of individual components to illustrate what makes them tick.

EDITOR'S CHOICE AWARD:
Only 9 and 10 verdicts are even eligible for the coveted Kick Ass award, the mark of PC excellence.

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THE SPECS: A roundup of system requirements and bundled hardware and software.

UNDER THE HOOD
- THE BRAINS
- DISPLAY
- STORAGE
- SOUND
- THE BUNDLE

PLUSES, MINUSES:
A quick summary for people who are too lazy to read the entire review.

PLUSES
Good Stuff

MINUSES
Bad Stuff

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KICKIN' THE TIRES ON THE LATEST HARDWARE AND TAKIN' THE LATEST SOFTWARE OUT FOR A SPIN

Hardware Photography by
AARON LAUER

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Dell Dimension XPS R450

A booming crate of TNT

While the Dell Dimension is stuffed with killer parts, its video accelerator single-handedly steals the spotlight. We're talking about the just-released nVidia TNT, the same chipset that garners kick-ass props on page 94.

State-of-the-art power, fancy accoutrements, and the best single-card video solution available today.

Dell uses STB's special system-vendor version of the Velocity 4400, which is loaded with a whopping 16MB of SDRAM. All that silicon, along with a 250MHz RAMDAC, helps the card achieve 32-bit color at 1600x1200 and blit like a wildhorse when you need 2D power the most. The system's record score of 185 in SYSmark 98 is a testament to the TNT's 2D power and video drivers.

The TNT's 3D capabilities are nonpareil for a hybrid 2D/3D chipset and even challenge the 3D-only acceleration of Voodoo²-based cards. In our *Forsaken* Direct3D test, the TNT ripped through the game's colored lighting and alpha-blending at 108fps, a gaudy score that says the accelerator could hit the 60fps sweet spot in more complex games.

Unfortunately, the Dimension's TNT card doesn't include a TV-out interface, despite the fact that nVidia's reference design supports TV-out and STB's standard Velocity 4400 includes the feature as well. The Dimension's TNT drivers also lacked all the cool adjustment toggles for D3D and OpenGL effects offered by the Velocity 4400 drivers.

Intel's 450MHz Pentium II perfectly complements nVidia's 3D accelerator, supplying all the raw floating-point power games need for geometry transformation, lighting, and the other types of polygon tomfoolery not handled by the video subsystem. Working in tandem with 128MB of memory, the P-II also helped set a record in our *Photoshop* desktop publishing test. And if you're looking for a dedicated image-editing machine, your *Photoshop* swap files will love the Kick-Ass 14.4GB IBM DeskStar hard drive, which spins at 7,200RPM and coughed up a respectable 11.8MB/sec in the HD Tach test, while demanding just 3.4% of the CPU's attention.

The Dimension's soundcard and speakers are also dreamy. The Turtle Beach Montego—which received a 9 verdict in our September issue—supports A3D, DirectSound, and DirectSound3D, and comes with a 4MB MIDI set. The Altec Lansing speakers hold up their end of the multimedia equation with tight frequency response and 34 watts of total power.

Sadly, the Dimension's DVD implementation is a blight on an otherwise kick-ass system. The third-gen Toshiba DVD-ROM drive actually posted slower performance than Toshiba's *second*-gen DVD-ROM drive (13.3x compared to 15.6x). The drive also had trouble reading CD-ROM golds.

We were most upset by Dell's strategy to go with hardware MPEG-2 decoding for DVD movies. With 450MHz of CPU power, this decoding can easily be done in software with a simple assist from the videocard. However, this requires proper video driver support, which we suspect was unavailable when the machine was engineered. MPEG-2 decoding was therefore left to a hardware decoder card, which increases the total price of the system and demands a PCI slot.

But whatcha gonna do? We love that TNT card, and we'll take it at any cost.

—Jon Phillips

UNDER THE HOOD

THE BRAINS	
CPU	Intel Pentium II 450MHz
L2 Cache	512K SBRAM internal
RAM	128MB SDRAM (expandable to 384MB)
Motherboard	Dell/Intel Seattle 440BX (ATX formfactor)
Drive Bays	Two open 5.25-inch
I/O Ports	One serial, one parallel, two USB, gameport, S/PDIF on MPEG-2 decoder
DISPLAY	
Video	STB nVidia TNT, 16MB SDRAM, AGP 2x
Monitor	Dell 1000HS (Sony Trinitron tube), 17-inch, 0.25mm dot pitch
Res/Refresh	1280x1024@75Hz
STORAGE	
Hard Drive	IBM DeskStar 14GXP 14.4GB, 7,200RPM, Ultra DMA IDE
CD/DVD	Toshiba SD-M1202 4.8x DVD-ROM
Removable	Iomega Zip
Fax/Modem	PCI US Robotics 56K X2 WinModem
SOUND	
Sound	Turtle Beach Montego A3D
Speakers	Altec Lansing ACS-295
OTHER	
Quadrant International DVD decoder (Zoran chipset), Dell QuietKey keyboard, Microsoft Intellimouse	
BUNDLE	
Windows 98 | Microsoft Office 97 Small Business Edition V2.0 | Bookshelf 98 Encyclopedia	

BOOT 1:01 DOWN 0:03

PLUSES

- Fastest 2D/3D card around
- 450MHz Pentium II
- Lotsa RAM
- 14.4GB hard drive
- Trinitron monitor
- Thumpin' speakers

MINUSES

- No TV-out
- Bare-bones video drivers
- Unnecessary hardware DVD decoding
- Little room for expansion

REAL WORLD BENCHMARKING

CPU/MOTHERBOARD bootMark		209
WINDOWS APPS SYSmark 98	official score	185
HARD DRIVE HD Tach	MB/sec	11.8
CD-ROM CD Tach98	drive rating	13.3x
3D RENDERING Newtek Inspire3D	sec	492
DESKTOP PUBLISHING Adobe Photoshop 5.0	sec	71
DIRECT3D ForsakenMark	fps	108.5
OPENGL Quake2 v3.15	fps	57.5

MAXIMUM PC VERDICT

Price $2,917 (with 17-inch monitor)
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EXPANSION NOTES

With no free IRQs and only one free PCI slot, the XPS R450 doesn't leave a lot room for tinkering. Luckily, the motherboard is packed with primo parts from the get-go.

EXPANSION MAP

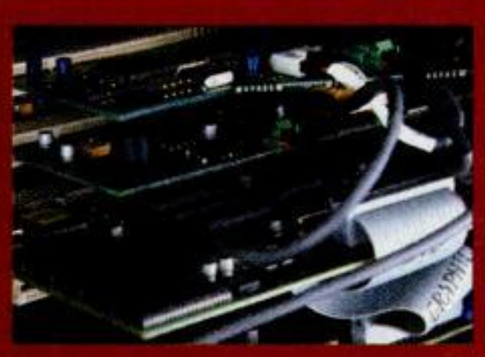
AGP	2D/3D videocard
PCI	Open
PCI	DVD decoder card
PCI	56K modem
PCI/ISA	PCI soundcard
ISA	Open

IROS

00	System timer	**08**	System clock
01	Keyboard	**09**	Soundcard
02	IRQ controller	**10**	DVD decoder
03	Modem	**11**	Videocard
04	COM1	**12**	Mouse
05	Soundcard	**13**	Num data proc
06	Floppy port	**14**	IDE controller
07	Printer port	**15**	IDE controller

DMAS

00	Soundcard	**03**	DMA controller
01	Floppy	**04**	Free
02	Soundcard		



You Push, I'll Pull To cool that P-II, an overhead fan blows cool air on the CPU while a flanker fan sucks out heat. The gigunda heatsink disperses any extraneous radiation.

Jockeying for Position Stuffing the PCI slots with a soundcard, modem, and DVD decoder card spells bad news for expansion: only one slot remains open. Software DVD decoding would have been preferred.

Everlasting Bass You'll need the Altec Lansing ACS295's deep-thumping bass-bump to enjoy the ambient sounds in your favorite games. It pumps 7 watts through each satellite and 20 watts through the 6-inch long-throw subwoofer.

Big Grillie Style Aperture grille monitors, like this 17-inch Trinitron, offer brighter, more uniform displays than their shadow-mask cousins. If you can spend another $578, you can get a 21-inch Trinitron that does 85Hz at 1600x1200.

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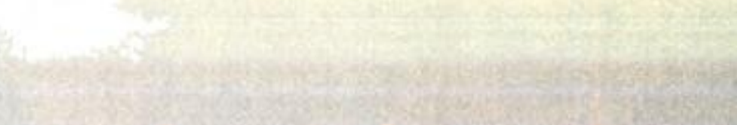
Quake II PERFORMANCE



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All tests in FPS. All cards run with vertical sync off. All cards tested on an Intel dual Xeon with 256MB RAM running Windows 95 with DirectX6.

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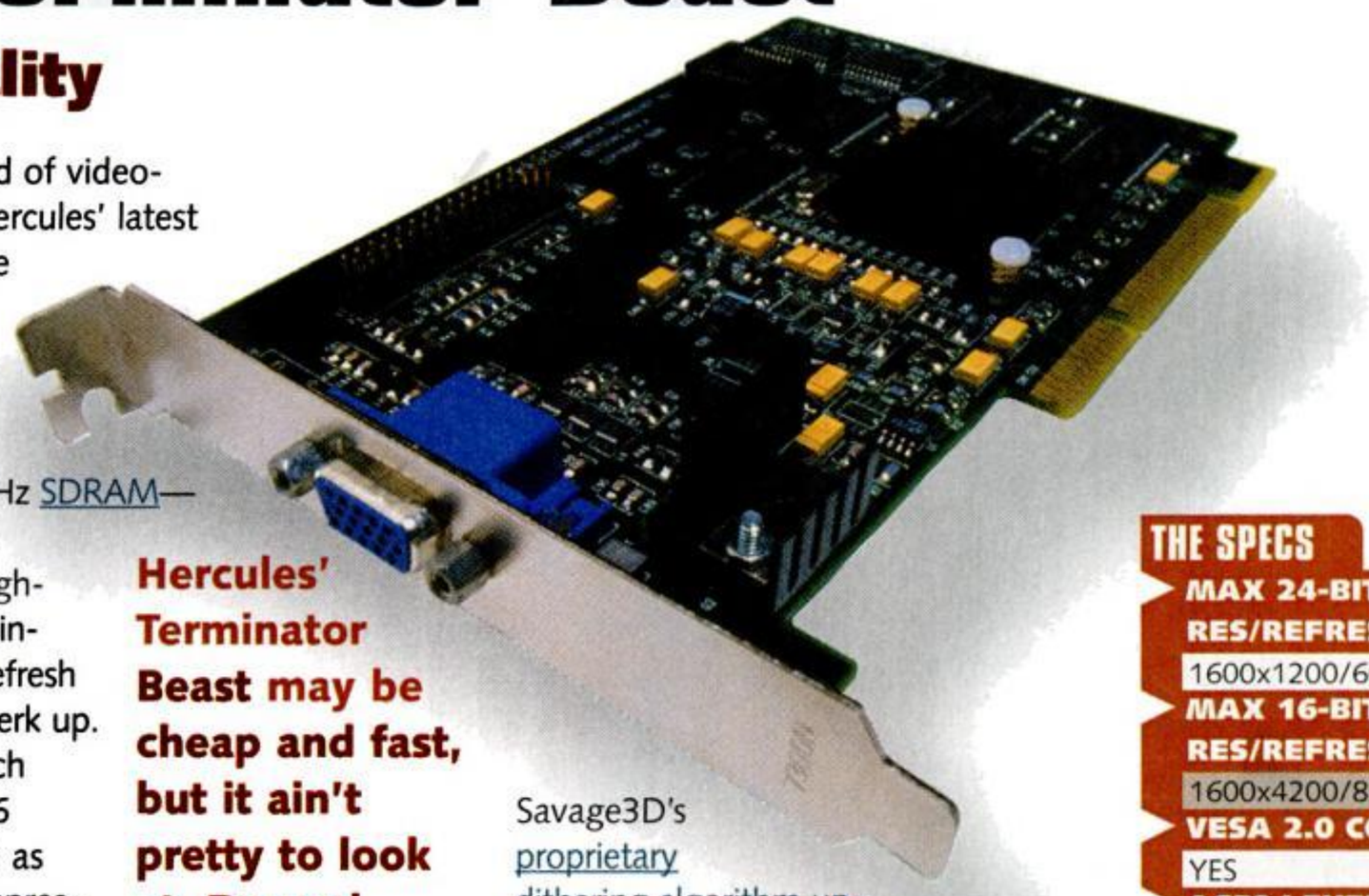
Hercules Terminator Beast

Speed before quality



Hercules' Terminator Beast may be cheap and fast, but it ain't pretty to look at. Darned those dithering algorithms.

It's dog-eat-dog out there in the land of video-cards, and the Terminator Beast is Hercules' latest creature to stalk the silicon landscape searching for fresh polygons to render—too bad its performance is trapped by some funky visuals.

This plain-Jane version of S3's Savage3D comes with 8MB of 100MHz SDRAM—the maximum the 3D architecture will handle. Hard-core 2D/*Photoshop* roughnecks may find true-color resolution hindered by this 8MB limitation. 16-bit refresh rates via the 250MHz RAMDAC do perk up.

The drivers include Hercules' Touch control applets, which allow DirectX6 adjustments such as auto-texture compression and trilinear mip-mapping. A miniGL driver (a GL-to-MTL wrapper) for *GLQuake*-based games was also tested.

PLUSES
- Fast D3D performance
- Single cycle trilinear filter for better visual quality
- Hardware support for texture compression

MINUSES
- Horrible rendering quality in D3D gaming
- GL drivers need work
- 8MB max memory inadequate for high-res 2D

At 800x600 *Forsaken*, the Beast kicked in an impressive 61.24fps on our 400MHz Pentium II—slower than the scores we recorded in our preview in the September 1998 issue (p. 87)—that board had 125MHz SGRAM onboard. Enabling texture compression yielded faster scores across the D3D games, though.

Hercules claims the Savage3D's proprietary dithering algorithm up-samples 16-bit games to 24 bits. But the Savage3D falls from grace in visual-quality. Throughout our gamut of D3D and *GLQuake* games, rendering quality—despite the smooth filtering and mip-mapping—suffers from dithering galore, with speckled artifacts throughout. Regardless of the texture-compression setting, the results were the same-funky, dithered output. This is readily apparent in any alpha-blending/transparency effects. We also caught visible texture seams during hi-res *Battlezone* action. Transparencies in *GLQuake*-based games are also undercooked, with almost opaque or screen-door/stippled effects where there should be smooth glass.

While the price and raw performance of the Terminator Beast are impressive, there are better looking solutions for the money. This Beast is nothing to roar about.

—Andrew Sanchez

THE SPECS

MAX 24-BIT RES/REFRESH RATE	1600x1200/60Hz
MAX 16-BIT RES/REFRESH RATE	1600x4200/85Hz
VESA 2.0 COMPLIANT	YES
AGP? LEVEL	YES/2x
AGP DIRECT MEMORY EXECUTION	YES
BUNDLE	Win95/98 drivers

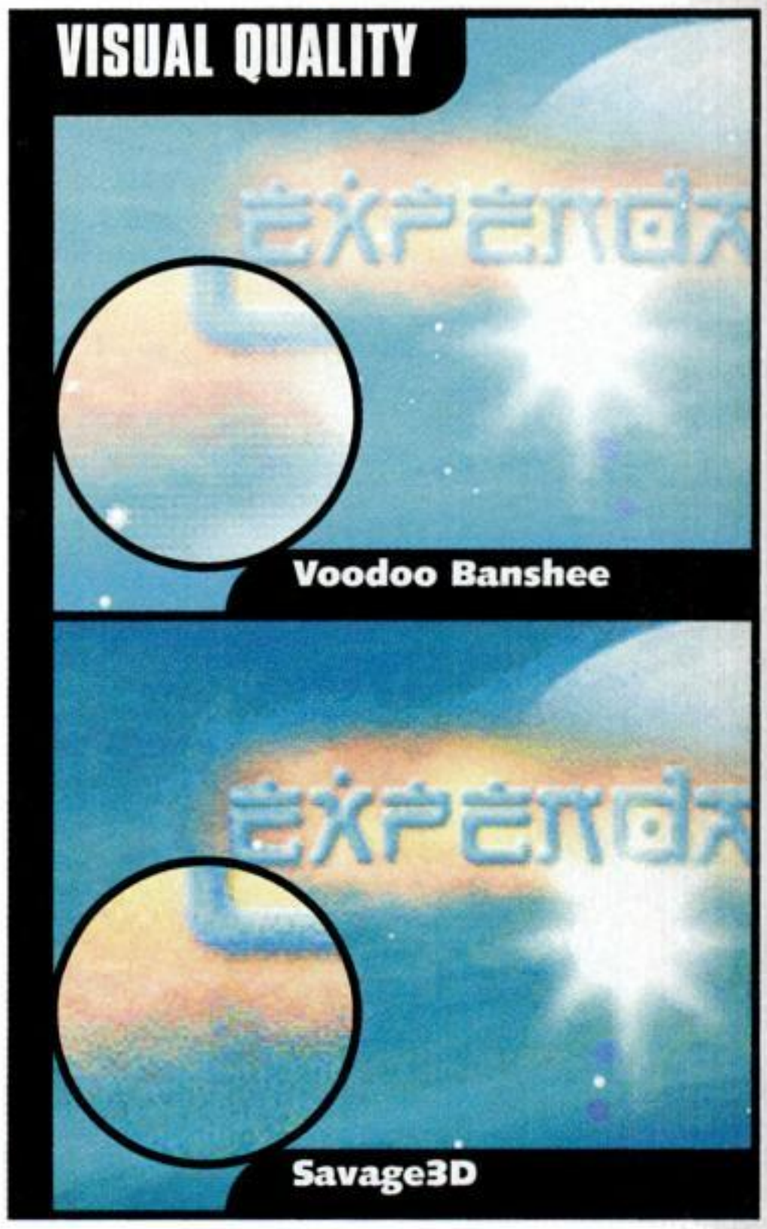
BENCHMARKING

REAL WORLD

FORSAKEN 800x600 fps	*61.24	
FORSAKEN 1024x768 fps	*40.16	
BATTLEZONE 800x600 fps	29.0	
BATTLEZONE 1024x768 fps	23.5	
QUAKE II 800x600 fps	27.0	ICD
	33.6	miniGL
QUAKE II 1024x768 fps	20.2	ICD
	23.3	miniGL

* Texture compression was disabled. V-sync, as always, is enabled.

VISUAL QUALITY



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6

WHERE'S THE VISUAL QUALITY?

To show just how itchy Savage3D's output is, we took two 640x480 screenshots from Rage's forthcoming arcade shooter *Expendable*. A DX6 rolling demo that employs hi-res textures, colored lighting effects, and alpha blending, *Expendable* gave us these two captures (one with Savage3D, the other with Voodoo Banshee), which show the horrible discrepancies.

The somewhat pale palette and horizontal banding of the Voodoo Banshee are typical of Voodoo rendering. Note the overall clarity of the image, with nary a wiggly pixel.

The Savage3D shot, however, shows those stray pixels sprayed all over the place. Notice around the edge of the lettering, where an alpha-transparency is taking place—you'll see pixels readily apparent throughout the image. This is not good.

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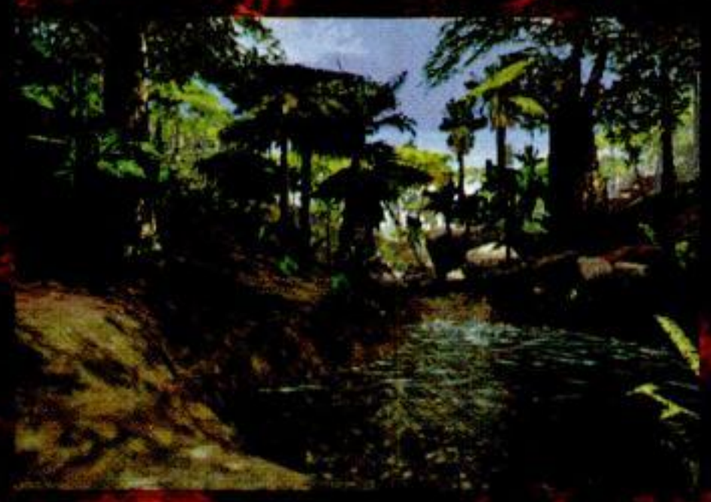

PHENOMENAL PHYSICS-BASED GAME PLAY: IF IT CAN HAPPEN IN REAL LIFE, IT CAN HAPPEN HERE.

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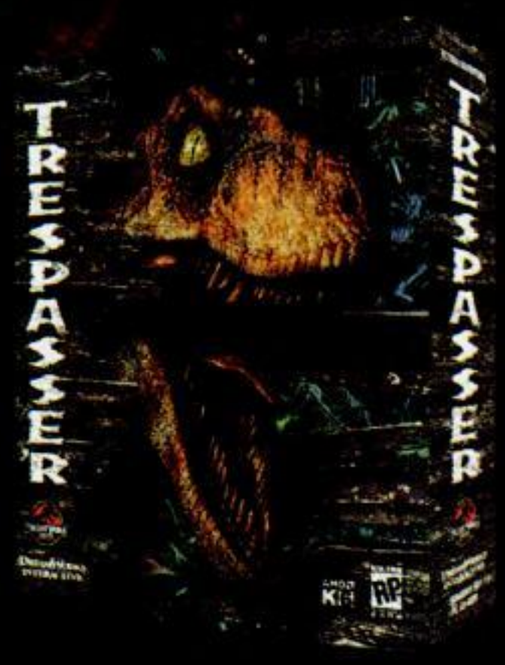

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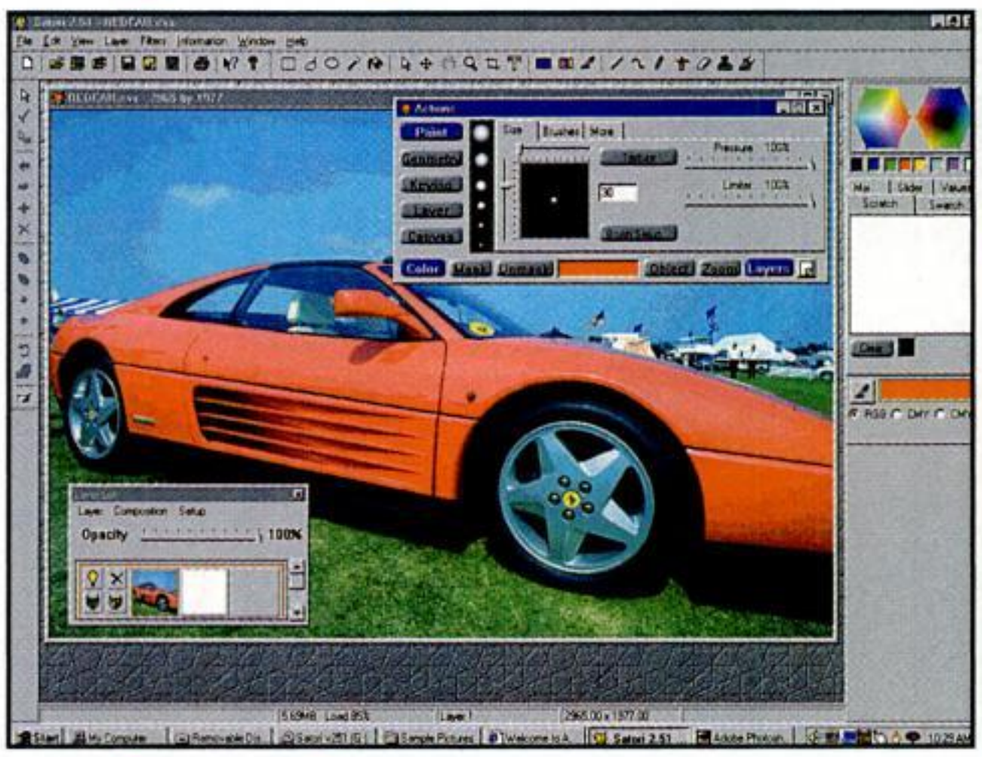
Satori PhotoXL 2.51

Resolution-independent painting for the masses

Graphic artists tired of waiting for huge image files to open in Adobe *Photoshop* will welcome *Satori PhotoXL*. Unfortunately, artists will lose some of that time savings to the program's intermittent crashes.

PhotoXL does everything you'd expect an app like *Photoshop* to do, such as object-based flood fills, magic wand, auto trace, masks, layers, alpha channels, and compositing. But unlike *Photoshop*, which tries to cram every single pixel into RAM, *PhotoXL* is resolution-independent, meaning it displays only the pixels you're working with, allowing artists to manipulate massive files quickly without the usual lag associated with applying multiple filters. Even in resolution-independence mode, artists still have access to all the pixels in an image.



PhotoXL lets users quickly manipulate large files in true color without the delays common to pixel-based editors such as Photoshop.

THE SPECS

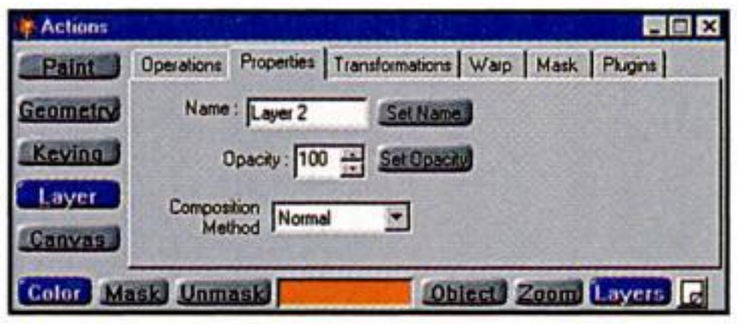
REQUIREMENTS
- Pentium or higher
- Win95/98/NT
- 64MB RAM
- 10MB of hard drive space

PLUSES
- Resolution-independent
- Object-based
- Very fast

MINUSES
- Buggy
- No CMYK support
- Little documentation
- Poor text handling

Object-based image editing is *PhotoXL*'s other strength. Every effect, brushstroke, and layer in a *PhotoXL* file is an object that can be edited and re-edited. All selections are saved as objects and can be edited later. Effects and filters applied to selection objects are modified as the selection is modified, and each effect and filter can be modified in turn.

PhotoXL's innovative Actions palette is the interface for all the filters and effects, and allows easy manipulation of the action settings. Actions are saved as objects, which can later be modified from the Actions palette. Another strength is *PhotoXL*'s pixel-precise dialog boxes. Moves, rotations, and object placements can be done by hand or numerically using relative or absolute pixel coordinates.



The Actions palette is the master control center for nearly everything than can be done in PhotoXL, including setting filter parameters, layer management and editing objects.

But while *PhotoXL* has a lot going for it in the feature department, it's buggy as hell. In three out of four attempts to load an RGB TIF file that *Photoshop* had no problem with, *PhotoXL* performed an illegal instruction and closed. Even with a clean reinstallation, *PhotoXL* choked on some files that were easily opened in *Photoshop*. And while *PhotoXL* is ideal for graphic artists who work with large files, print artists will be disappointed that it doesn't support CMYK color mode. Users familiar with other resolution-independent applications such as *LivePicture* will find *PhotoXL* daunting. Artists will also find that *PhotoXL* lacks *Photoshop 5.0*'s fine-tuned color-management tools, text handling, filter previews, and easy access to clipping and paths.

PhotoXL is positioned as a replacement for *Photoshop*, though most users will find it a useful companion, rather than a substitute. Without CMYK support, most of its benefits are lost to artists working at screen resolutions for the Internet or CD-ROM.

—Rick Sanchez

DARE TO COMPARE

	ADOBE PHOTOSHOP	SATORI PHOTOXL
Load 30MB file (min:sec)	0:18	0:07
Apply simple blur	0:22	0:06
180-degree rotation	0:32	0:07

MAXIMUM PC VERDICT

Price $150
Company Spaceward Graphics
Phone 011.44.1954.261333
URL www.satoripaint.com

6

MAKE IT GLOW

First load up a background image in a new canvas. Then place a 32-bit image with a mask into the second layer of your canvas using the "Load to Layer" command.

Next you'll need to create a new layer. Name it "Glow" and fill the layer with a color using the "Clear Layer" command on the "Layer" menu.

To cut a mask in the colored layer, choose the "Load to Layer" command and the "Load to Current Layer User Mask" option and open the file that has your second image and mask, in this case it's the gargoyle. This will make a gargoyle-shaped hole in the color layer. Using the "Invert Mask" button on the Layer palette, we now have a green shape that matches the gargoyle.

To create the glow, select the "Geometry" palette, click the "Mask" button, select a shape, in this case a rectangle. Select "Blur" from the "FX-1" palette, right click on the image and select "Fill Canvas." This will create a blurred green background that can be moved below the gargoyle using the "Move" button on the "Layers" palette.

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You won't need cheat codes
with one of these. . .

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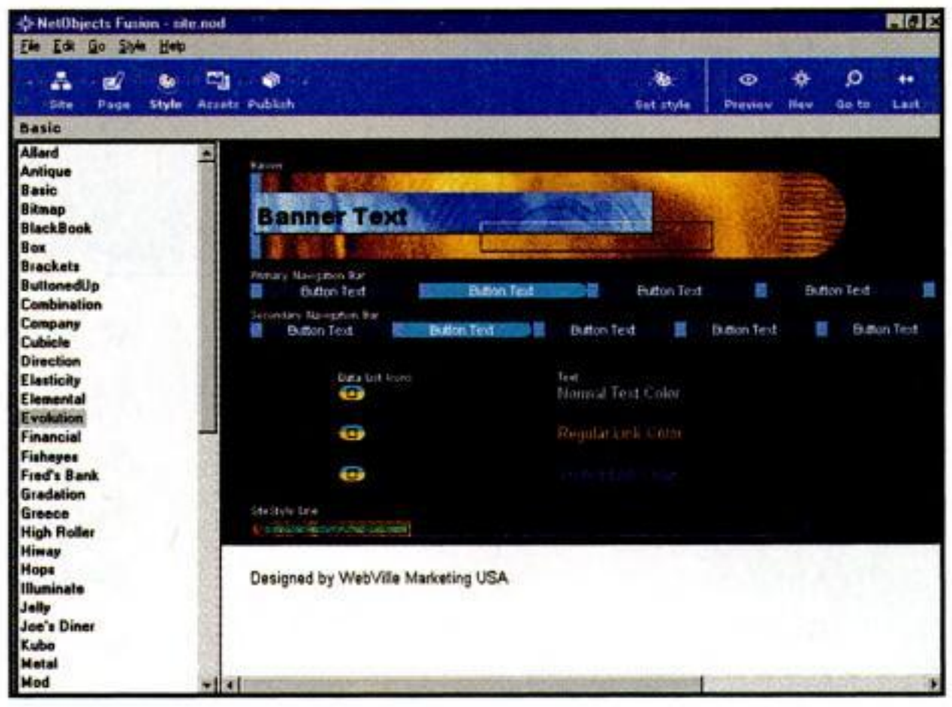
NetObjects Fusion 3.0

Oh what a tangled web it weaves

It's been two long years since the last upgrade to NetObjects' *Fusion*, and since then the web has undergone many changes. Unfortunately it looks like nobody bothered to tell NetObjects about any of them.

To its credit, NetObjects has the right idea: give web designers authoring tools that allow them to pick the styles and features they want, drop in content, and automatically generate HTML scripts, interactive web pages, and the like. Page designers shouldn't have to worry about the details of the code behind the curtain. *Fusion* creates the NOD file from which all other components on your web site are generated. The NOD file acts like a template, allowing you to choose styles and interactive features just using pull-down menus.



Fusion 3.0 gives you a large selection of styles and features to choose from, but the code it generates is last year's model.

THE SPECS

REQUIREMENTS

- 90MHz Pentium
- Windows 95/NT 3.51
- 50MB hard disk space (100MB for full installation)
- 32MB RAM
- 60MB hard disk space for virtual memory
- 800x600/256-color display
- CD-ROM drive
- Netscape 2.01 or higher
- IE 2.1 or higher

PLUSES

- Lots of styles to choose from
- Good organizational features
- Lets you easily generate a site for personal use

MINUSES

- Generates outdated code
- Uses nested tables
- Pages will inhibit your site's interoperability
- Code inadequate for professional, commercial, or corporate use

Many features have been added to version 3.0. The user interface is much more intuitive, and the app now generates what NetObjects calls "Everywhere HTML," which amounts to Dynamic HTML (DHTML). Unfortunately, DHTML isn't a true standard, but instead is a mix of HTML 3.2, browser-specific JavaScripting, and browser-specific Cascading Style Sheets (CSS), despite the fact that there are now two style-sheet standards (CSS1 and CSS2).

NetObjects claims *Fusion* can generate these components so they work the same in both *Navigator 4.0* and *Internet Explorer 4.0*, but scripting within nested tables just plain doesn't work, and nested tables is the default setting. You rarely want to use nested tables; they take forever to download and all the images they could potentially contain have to download before your text loads. So the first thing you need to do is change your settings to the "Regular Tables" mode. But, of course, regular tables are harder to position correctly using HTML 3.2, so there's a trade-off.

Luckily, *Fusion*'s HTML Access features let you add or edit such scripting and style-sheet components by hand for effects that will work the same in both browsers. But what's the point of using the tool if you have to fix everything by hand?

NetObjects makes some incredible claims about its product. It's supposed to be everything a web master needs to design, create, publish, and maintain a web site. However, *Fusion* generates pages written in outdated code that will eventually hinder the usefulness of your site. If your only goal is a personal homepage, *Fusion* should work for you. But if your goal is to set up a commercial site, a store front, or a corporate extranet site that could potentially be interacting with other web sites, the code *Fusion* generates will "break" when other sites try to access your content.

Fusion comes with more than 50 stylish web-ready templates and style views. These templates direct you in choosing how you want content formatted on your web page.

—*Lisa Rein*

MAXIMUM PC VERDICT

Price $295 ($99 Upgrade)
Company NetObjects
Phone 888.888.8993
URL www.netobjects.com

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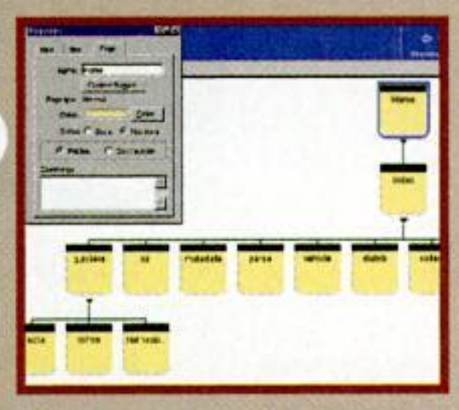
For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

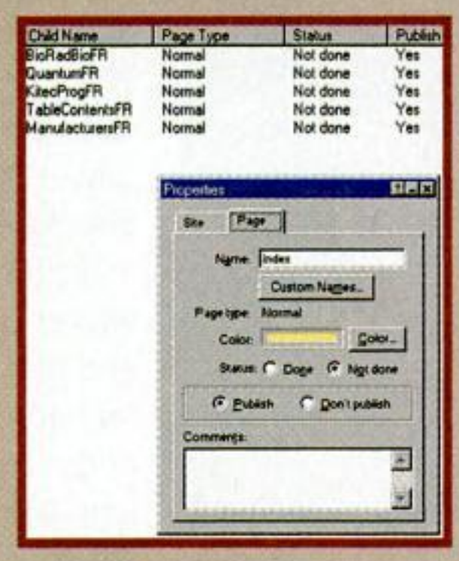
USING NETOBJECTS FUSION ON YOUR EXISTING WEB SITE

We imported an existing web site to try adding some new features.

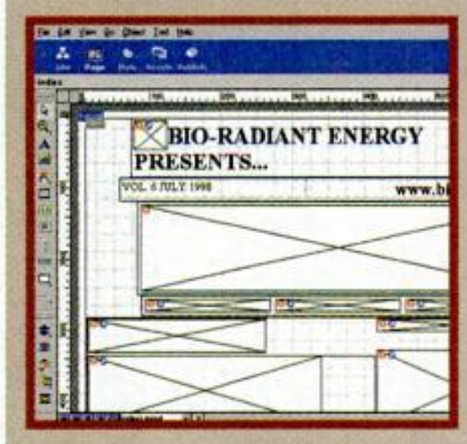
Importing our site was enlightening. It immediately created both a textual and a graphical representation of our existing web site and made it easy for us to understand its structure.



Select Import Web Site from the File menu. *Fusion* provides you with five "views" of your site: site view, page view, style view, assets view, and publish view. Select Local Site to read in the files from your hard drive. Enter the domain name and how deep you wish it to go when it verifies your hyperlinks.



The Site View provides you with a graphical overview of the architecture of your site: all the pages, and which pages lead to where. These can be dragged and dropped to change the order. Numerous style templates are included. The Publish View lets you post your files to your live site with a click of a button.



Finally, select the starting page of your web site (usually index.html), and *Fusion* will suck up your pages and spit out a site that looks great but ultimately sucks, due to its inconsistent, outdated code structure.

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trueSpace 4.0

High-end animation at a low-end price

Realistic volumetric lighting effects in trueSpace 4.0 make birthing aliens in pools of violet light almost believable.

MAXIMUM PC KICK-ASS! product

With collision detection, metaballs, inverse kinematics, and forward dynamics already incorporated into version 3.0, *trueSpace 4.0* brings an awesome new hybrid rendering engine, an intuitive 3D interface (for most functions), OpenGL hardware acceleration, boning, scripting, volumetric lighting, and per-face UV mapping, all at a quarter of the price of *3D Studio Max* and *Lightwave*.

THE SPECS

REQUIREMENTS

- Windows 95, 98, or NT 4.0
- Pentium 120
- 32MB RAM
- 20MB hard disk space
- VGA Graphics
- 3D videocard

PLUSES

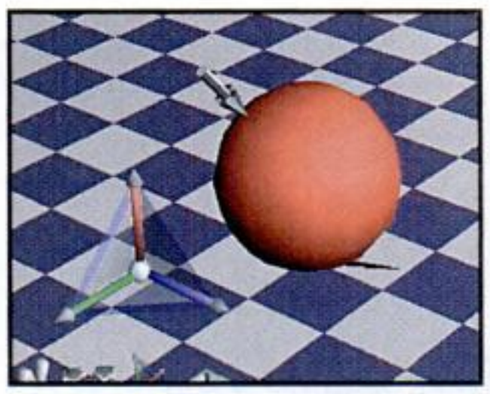
- Intuitive icon-based interface
- Keyframe editing provides control of motion parameters
- Hybrid radiosity renderer gives high quality for price
- Real volumetric effects make special effects possible

MINUSES

- Numerous icons overwhelming
- High-end hardware-acceleration required

trueSpace now uses Lightworks Design's engine, which can render in Phong, Raytrace, and Radiosity modes simultaneously. The difference in lighting effects for architectural renderings is incredible. But this comes at a price: The video subsystem requires significant OpenGL hardware acceleration. Lower-end accelerators are only effective at 800x600.

In the past, *trueSpace*'s interface was encumbered by hidden icons and dialog boxes that disappeared immediately after use. Version 4.0 addresses this shortcoming with an icon-based function selector, which floats until the user chooses to hide it. These "widgets" provide access to functions previously hidden: rotate, scale, and move in any axis (or group of two axes) by merely clicking and dragging on the persistent tripod icon. This scheme is used for face and NURBS editing. World manipulation is available from the new Global Panel, which lays out functions such as grid, rendering, menu visibility, and collision settings on a floating plane in 3D space. It takes a little getting used to, and the old dialog-box system is still there, but once mastered, this improvement is comparable to typing at the C: prompt versus using a GUI. Some will balk, but most will switch.



The tripod-shaped "widget" permits moving, scaling, and rotating without dialog boxes.

trueSpace now supports boning to animate meshes. Muscular deformations are editable and viewable in realtime. Since creating and manipulating skeletal objects is directly reinforced with kinesthetic feedback from the user, this task is much more intuitive than the lengthy dialog boxes and angular settings used by other programs.

Volumetric lighting adds a cornucopia of dramatic effects, such as realistic fog and clouds that are useful for projecting images gobos and light beams through space.

Another high-end feature added is scripting. Simple games like *Pong* and even mind-boggling 3D titles can be created from *trueSpace* objects using a scripting language as friendly as Basic.

Animation keyframing has dramatically improved with the addition of function curves to the Keyframe Editor. More natural movement with accelerated and decelerated motion defined by spline curves puts *trueSpace* right up there with the big boys.

Much-requested features such as textures assigned to individual faces, dynamic polygon creation and embedding, seamless movement from modeling to VRML environments, and dynamic selection of disparate object types make *trueSpace 4.0* perfect for game developers.

trueSpace 4.0 is worth several times its relatively modest price.

—Rick Stevens

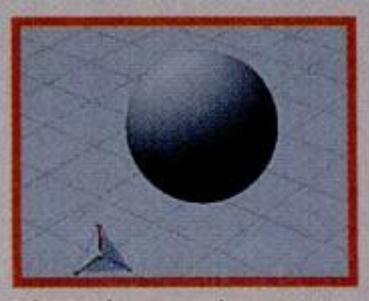
MAXIMUM PC VERDICT

Price $595
Company Caligari
Phone 650.390.9600
URL www.caligari.com

9

CREATING A DRAMATIC LIGHTING EFFECT

- Create a plane object by clicking on the Plant Primitive icon. Scale the plane object until it covers the ground plane entirely by selecting the Scale Object icon and dragging in the main window with both the left and right mouse buttons pressed.
- Create a sphere object by clicking on the Sphere Primitive icon.
- Create a Projector Light by clicking on the Projector Light icon. Move the projector light up the Z axis above the sphere and slightly off the center of the sphere.
- With the projector light still selected, click on the Look At icon, then on the sphere to tilt it toward the sphere.
- With the projector light still selected, click on the blank box beside Project in the light dialog and assign a targa file to the projector. Also, check the volumetric box and click on the Toggle shadow casting by current light icon.



The sphere and projector light before rendering.

The finished rendering in trueSpace 4.0.

- Set the light intensity to about 66% with the slider in the light dialog.
- Set rendering options to raytracing, medium quality, foreground "volumetric" and background color to black.
- Click Render Scene icon.

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VIPER Racing

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ESRB

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www.sierrasports.com

Velocity 4400 and Viper V550

TNT's on top of the wooorld!

Last year, nVidia rolled out its Riva 128, and despite dithered textures and blocky filtering, that 2D/3D board turned out to be the most powerful all-in-one accelerator.

This year, visual quality is the buzzword. And everyone and his grandma, including S3's Savage3D (previewed in October 1998), Matrox's MGA-G200 (reviewed in September 1998), and 3Dfx's Voodoo Banshee (previewed in October 1998), claim they can deliver texel-titillating goodness with nary a stray pixel or blocky texture.

Guess who's leading the visual-quality charge into 24-bit rendering perfection? nVidia, with its 2D/3D 128-bit TwiN Texel architecture.

Designed to be the best Direct3D accelerator ever to grace the 3D world, its dual-32-bit graphics-pipeline-processing pixels slather on multipass texturing in a single pass, bump-mapping, and more. And with a 24-bit accurate Z-buffer, you can expect next-generation games to look beautiful at 16 million colors. All this doesn't mean OpenGL doesn't get attention from TNT—on the contrary, a full ICD will allow you to run *GLQuake*-based games and *Lightwave3D* without a hitch.

The 2D/3D integrated video chip realm now has a new king of the hill—the nVidia TNT.

—Andrew Sanchez

STB Velocity 4400

PLUSES
- Riva TNT sets new performance standard for 2D/3D
- Awe-inspiring Direct3D accelerator
- 24-bit Z-buffer
- Better TV-output Control Panel
- 250MHz RAMDAC
- Composite and S-Video output
- Solid Control Panel for D3D and OGL apps

MINUSES
- Not as fast as dual-Voodoo² in OpenGL apps
- Displays only 320x240, 640x480, and 800x600
- Output to monitor or TV, but not both
- Refresh rates aren't as high as Viper 550

Diamond Viper V550

PLUSES
- Riva TNT sets new performance standard for 2D/3D
- Awe-inspiring Direct3D accelerator
- 24-bit Z-buffer
- 250MHz RAMDAC
- S-Video output (composite adapter included)
- Handy integrated control applet

MINUSES
- Not as fast as dual-Voodoo² in OpenGL apps
- Driver displays out-of-resolution range output into TV
- Limited TV-out display resolutions
- Output to monitor or TV, but not both

STB Velocity 4400

MAXIMUM PC KICK-ASS! product

An nVidia faithful, STB adds the 4400 to its line of Velocity videocards, a name befitting this fastest of fast videocards.

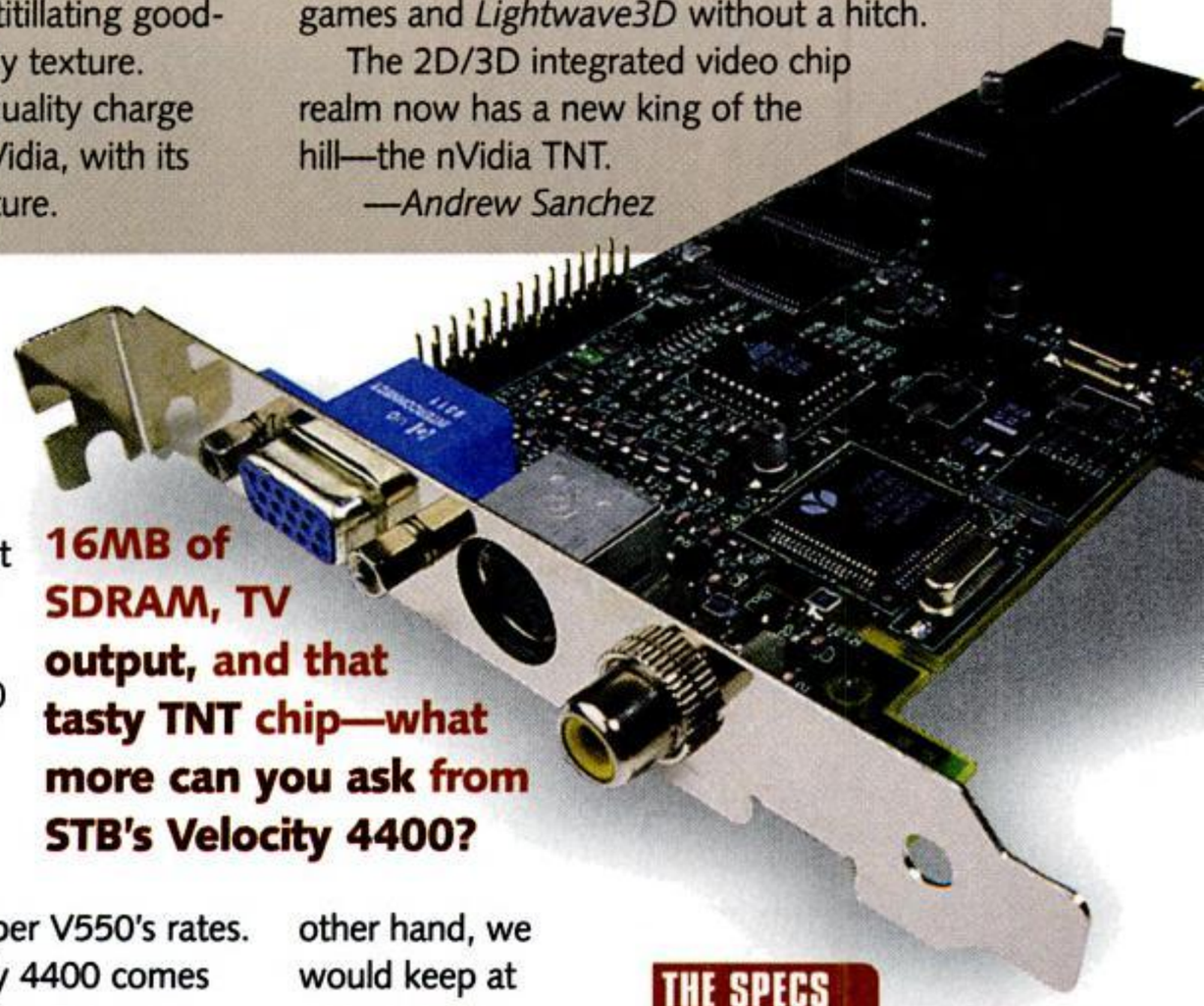
Following reference specs, the Velocity 4400 harbors 16MB of nonupgradable 125MHz SDRAM coupled with a 250MHz RAMDAC. Curiously, the Velocity 4400's refresh rates are lower than the Viper V550's rates. Unlike the Viper V550, the Velocity 4400 comes with separate S-Video and composite TV outputs powered by BrookTree's 869KRF TV decoder chip, on top of the standard monitor connector.

STB's drivers let you control TV-centering keys, fine-tune Direct3D and OpenGL visual attributes such as auto mip-mapping and filtering, and more.

Apart from a slightly slower *Battlezone* benchmark, every other test put the Velocity 4400 neck-and-neck with the Viper V550, with fractions of a framerate separating the two. D3D at 1024x768 looks especially delectable. OGL gaming, on the other hand, we would keep at 800x600. At 1024x768, framerates bogged down to the high 30s—dual-Voodoo² does 60fps under the same conditions.

2D output remained sharp and eye soothing, as did gaming under the TV output. This iteration of BrookTree decoding came out clearer. Still, the 60Hz nature of TV output begs for gameplay, not word processing.

Dig it—this card is one powerful piece of silicon that's ready to rip into any of your games.



16MB of SDRAM, TV output, and that tasty TNT chip—what more can you ask from STB's Velocity 4400?

REAL WORLD BENCHMARKING
FORSAKEN 800x600 fps 104.9
FORSAKEN 1024x768 fps 69.3
BATTLEZONE 800x600 fps 41.9
BATTLEZONE 1024x768 fps 40.0
QUAKE II 800x600 fps 58.3
QUAKE II 1024x768 fps 39.6

NOTE: V-Sync is enabled for all results. Benchmarks were taken at the highest refresh rate the videocard would allow (140Hz for 800x600, 100Hz for 1024x768) to alleviate V-Sync bottlenecks.

THE SPECS

MAX 24-BIT RES/REFRESH RATE	1920x1200/76Hz * 32-bit
MAX 16-BIT RES/REFRESH RATE	1920x1200/76Hz
VESA 2.0 COMPLIANT?	Yes
AGP?/LEVEL	Yes/2x
AGP DIRECT MEMORY EXECUTION	Yes
BUNDLE	Win95/98 drivers I Web3D I Forsaken I Colorific 3Deep I 3D Sensations I Digital Video Producer

MAXIMUM PC VERDICT

Price $199
Company STB
Phone 972.234.8750
URL www.stb.com

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Diamond Viper V550 AGP

Slithering like its namesake into your AGP slot is Diamond's Viper V550. Based on a low-sitting NLX formfactor, the Viper V550 comes complete with a sweet 250MHz RAMDAC and 16MB of nonupgradable 125MHz SDRAM packed on its petite PCB. Expansion ports consist of your typical 15-pin monitor connector and a solo S-Video output (Diamond provides an S-Video-to-composite adapter). A BrookTree 869RF TV decoder chip takes on TV duties, with resolutions limited to 320x240, 640x480, and 800x600.

As we put the Viper V550 through our flurry of D3D and OGL benchmarks, it became readily apparent that TNT would dominate. At 800x600 *Forsaken*, this board pushed framerates into the triple digits, while 1024x768 came sliding in at a smooth 72fps. Under *Quake II* and with OGL multitexturing in full-effect, the TNT rampage continued, with 800x600 sticking firmly at 58fps, the fastest we've seen from any integrated part.

Diamond's Viper V550 is a bombastic 3D accelerator that can push D3D games as hard as any Voodoo² board.

2D performance is sharp and clear—too bad that can't be said about the TV output. With Diamond's helpful InControl applets running behind the scenes, the only thing keeping this card from achieving perfection are the lackluster TV-output control (on or off...that's it), and the driver's inability to limit your visual output when TV mode is enabled.

Despite this, TNT delivers awesome 2D and 3D performance that's $150 cheaper than a dual-Voodoo² scenario.

THE SPECS

MAX 24-BIT RES/REFRESH RATE
1920x1200/85Hz * 32-bit

MAX 16-BIT RES/REFRESH RATE
1920x1200/85Hz

VESA 2.0 COMPLIANT?
Yes

AGP?/LEVEL
Yes/2x

AGP DIRECT MEMORY EXECUTION
Yes

BUNDLE
Win95/98 and NT 4.0/5.0 drivers | DirectX 6.0 | Motorhead SE | Fremont SE | Microsoft Game Sampler for Windows 98 | CyrstalGraphics 3D Sensation | Software DVD | MGI Photosuite SE | Platinum WIRL and VR Creator | Back Web

REAL WORLD BENCHMARKING

FORSAKEN 800x600	fps	104.1
FORSAKEN 1024x768	fps	72.4
BATTLEZONE 800x600	fps	46.9
BATTLEZONE 1024x768	fps	44.9
QUAKE II 800x600	fps	58.4
QUAKE II 1024x768	fps	39.4

NOTE: V-Sync is enabled for all results. Benchmarks were taken at the highest refresh rate the videocard would allow (140Hz for 800x600, 100Hz for 1024x768) to alleviate V-Sync bottlenecks.

MAXIMUM PC VERDICT

Price $199
Company Diamond Multimedia
Phone 800.468.5846
URL www.diamondmm.com

9

THE VISUAL-QUALITY QUESTION

How does nVidia's latest and greatest stack up visually against its older brethren? Have those dithered textures and blocky texels given way to finely filtered polygons and deep, rich colors? Yes. Gone are those problems, and now TNT gives up much bilinear/trilinear-filtered goodness. Transparencies and alpha-blends look terrific, with no texture seams in sight. From Rage's DirectX 6–pumping *Expendable*, to Microsoft's *Motocross Madness*, visuals (especially at 1024x768) were top-notch and running at screaming framerates.

Our only qualm—gamma correction on *GLQuake*-based apps default pretty dark—adjustments are necessary to get the best frag for your buck.

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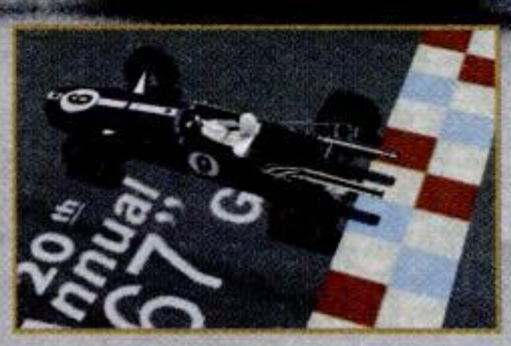
In 1968, they changed the rules of Grand Prix racing to cut down on driver fatalities.

Welcome to 1967.



Pulling out of a power slide. G-forces throwing you around the cockpit. You realize you're sitting behind the truest 3D engine ever built. Racing the likes of Jack Brabham and Jim Clark. At Monza, Spa and Nurburgring. 1967 was a historic turning point in Formula One racing. Welcome to Grand Prix Legends™. Racing sims will never be the same.

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Micro Express NP6266

A commendable contender

You shouldn't judge this notebook by its cover, or in this case the "lowly" AMD K6 processor. In fact, you'll probably be surprised to discover how good this book really is.

Frankly, we were astounded. With the exception of the agonizingly awful video chip—Trident's 4MB Cyber 9397—there's a lot to recommend here, including the mid-sized 13.3-inch TFT display, 4GB hard drive, and integrated CD-ROM and floppy disk, all of which ran Windows 98 with nary a glitch.

Although the 13.3-inch active-matrix display isn't the biggest in its class, it's still a beauty, offering bright images with good contrast.

Of course, AMD processors have always suffered substandard floating-point performance, and nowhere is this more apparent than in our 3D-rendering test. The NP6266 took more than 20 minutes to render our 3D scene, more than 30% slower than a similarly equipped 266MHz mobile Pentium II. However, the mobile 266MHz K6 scored a quad trick in our four other system benchmarks, besting the 266MHz mobile Pentium MMX on average by more than 10%. And it came precariously close to beating a couple of the 266MHz Pentium II–equipped notebooks (reviewed in the October 1998 issue).

The NP6266's 4GB hard drive posted a robust transfer rate of 5.25MB/sec, and the 24x CD-ROM drive, which actually spins at only 15.7x, is still the second fastest mobile CD-ROM drive we've seen to date. Even better, both devices ship with their DMA setting turned on.

As stated, the Trident video subsystem is atrocious, but the NP6266's MPEG video playback looked a far-sight better than other notebooks we've seen using the chipset, such as Micron's Trek[2]. Banding and ghosting were still visible, but less drastic. Unfortunately, the Direct3D performance was much worse, with alpha-blending problems aplenty. And framerates crawled at a slideshow pace: 1.24fps (running *Forsaken* at 800x600) on the NP6266 vs. 5.59fps on the Trek[2].

Other goodies include wavetable audio—courtesy of ESS's always dependable Maestro chipset—and a 56Kbps PC card modem. An integrated modem would've been preferred, however, especially since the left side of the case is already primed for it.

We also appreciated the NP6266's rounded aesthetics. The keyboard, speakers, and trackpad sport subtle artistic curves and contours. (Heston himself would adore the bullet-shaped hinges!) The mouse buttons even include raised edges to make menu execution more intuitive.

The NP6266 is a solid choice—at a good price—and should suffice for the majority of your computing needs. Just beware, and be aware, of its multimedia limitations.

—Bryan Del Rizzo

UNDER THE HOOD

THE BRAINS	
CPU	266MHz AMD mobile K6
RAM	64MB (expandable to 384MB)
I/O Ports	Single PS/2, dual USB, S-Video-out, RCA-in, port replicator, parallel, serial, full-sized gameport, audio-in, audio-out, dual PC card
Modem	Billionton 56Kbps PC card fax/modem
DISPLAY	
Videochip	Trident Cyber 9397 with 4MB of video
Display	13.3-inch TFT
Res/Refresh	1024x768@32-bit
STORAGE	
Hard Drive	Toshiba 4GB EIDE hard drive
CD-ROM	Toshiba 24x EIDE CD-ROM drive
SOUND	
Sound	ESS Maestro wavetable/FM audio
Speakers	Stereo speakers

BOOT 1:02 DOWN 0:08

REAL WORLD BATTERY LIFE

02:40:00

REAL WORLD BENCHMARKING

CPU/MOTHERBOARD	88.3
WIN95 APPS	71
HARD DRIVE	5.25
CD-ROM	15.7x
3D RENDERING	1244
DESKTOP PUBLISHING	225
DIRECT3D	1.24
SPREADSHEETS	286

PLUSES

- 266MHz K6
- 13.3-inch screen
- Fast CD-ROM drive
- Low price

MINUSES

- Video performance
- Floating-point performance

MAXIMUM PC VERDICT

Price $1,899
Company Micro Express
Phone 800.989.9900
URL www.microexpress.net

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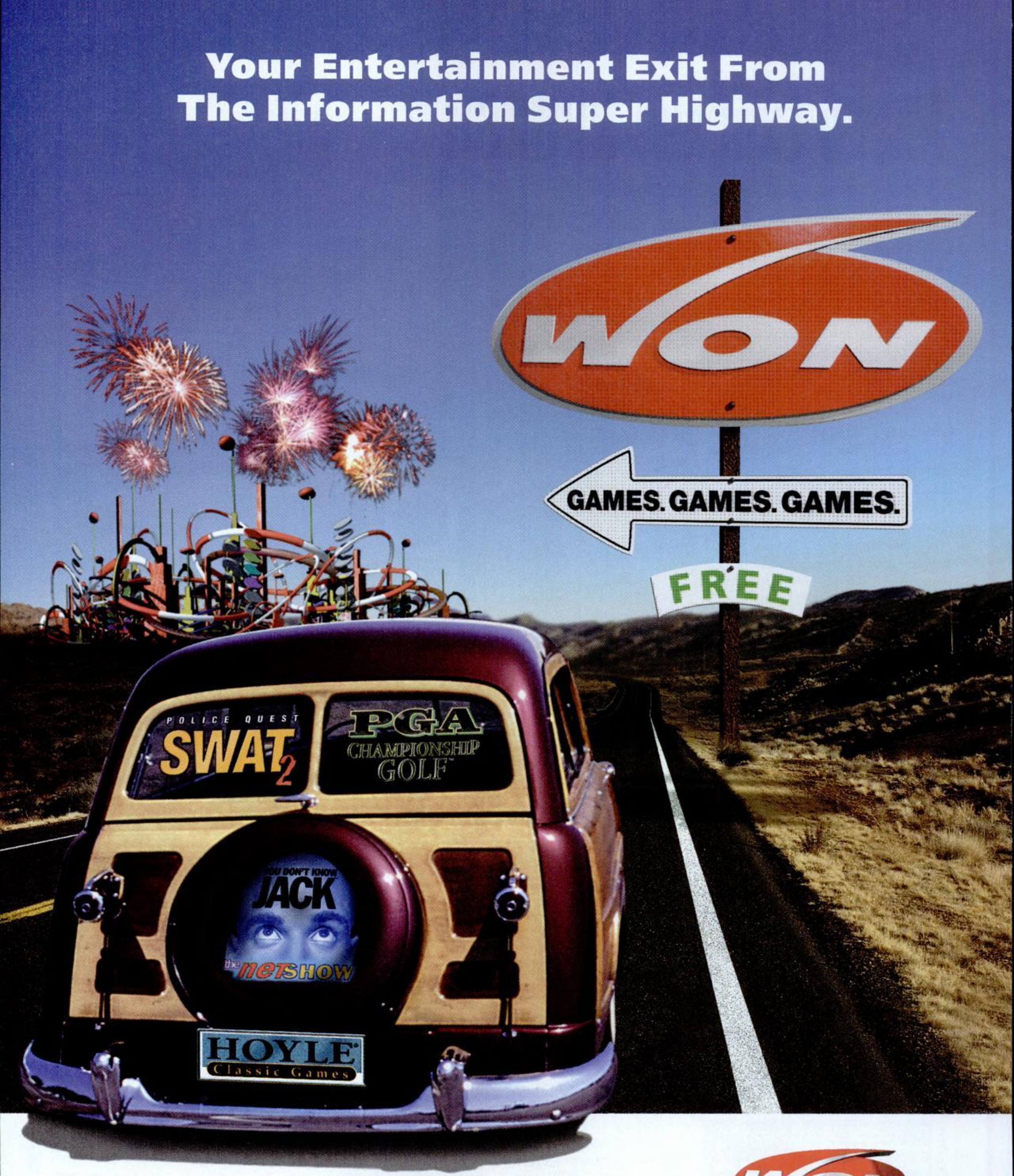

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Tom Clancy's Rainbow Six

Fight fire with fire

In *Tom Clancy's Rainbow Six*, it's up to you and an elite squad of commandos to put the smack down on terrorists. Fusing the addictive speed of first-person shooters and the cerebral intensity of strategy games, *Rainbow Six* breaks the mold of tired genres with some innovative approaches. Unfortunately, a few problems hold *Rainbow Six* from revolutionary greatness.

Seething with tension, *Rainbow Six*'s gameplay is spot-on. This is no "run around, pick up item, shoot from the hip" kind of game. *Rainbow Six* is all about clandestine sneaking and subterfuge, setting way points, and initiating troop commands. One hit and you're dead. Careful planning and surgical precision are required to see a mission through to completion.

The detail in *Rainbow Six* is nothing less than stellar, with a bounty of cutting-edge anti-terrorist equipment, mission objectives that vary from direct assault to hostage rescue to disarming bombs, and exceptional sound effects and music. Character animations are fluid and move with an unnerving realism.

Savvy graphics fiends might feel let down by *Rainbow Six*'s bland environments. It has nowhere near the graphical grandeur of *Unreal*, but the graphics adequately convey a real world with Direct3D resolutions up to 1024x768. However, some flagrant ugliness compromises the tension, including dreadful clipping problems. Filtered textures range from an appalling 8x8 up to a much more palatable 256x256. Some environments are merely flat polygons, giving you the sensation that you're walking though a paper house.

The tension is heavy and the action is plenty in Rainbow Six.

Horrible polygon collision detection makes for some silly moments.

What a pixelated mess! The graphics in Rainbow Six leave something to be desired.

Framerates are consistent, but could use tweaking, hovering between 20fps and 30fps, even on burly machines.

Spotty AI results in your troops bunching up in hallways and terrorists continuing their patrol while their buddies get mowed down in front of them. This can be particularly troublesome when your flanks get stuck because they block each other's exit, and neither will move.

It's a good thing *Rainbow Six* is multiplayer-ready via TCP or over the Internet with Mplayer. A variety of deliciously addictive and compelling head-to-head scenarios are available, including one twist on a capture-the-flag scenario that has two teams attempting to infiltrate each other's strongholds to rescue hostages.

Insta-fraggers might be miffed at the cumbersome interface for mission planning. It can be tedious, as it's comprised of an unintuitive mishmash of orders and waypoints, but thankfully, Red Storm has included mission plans for the first four scenarios. Once you get used to the design and tactics, you'll be creating your own flawless tactics in no time.

Despite a few eyebrow-raising glitches, *Rainbow Six* breaks new ground with exciting and innovative gameplay, and carves its own niche in an over-populated world of carbon-copy clones.

—Dan Simpson

PLUSES
- Perfect blend of action and strategy
- Tense mood
- Super-addictive gameplay

MINUSES
- Bland graphics
- Befuddling planning interface

THE SPECS

3D CARD SUPPORT
Direct3D

SOUND SUPPORT
DirectSound3D

MULTIPLAYER
TCP/IP
Modem

MAXIMUM PC VERDICT

Price $50
Company Red Storm Entertainment
Phone 919.460.1776
URL www.redstorm.com

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BREAKING AND ENTERING

Nothing hurts more than watching your deviously designed plan fall down around you. Keep in mind the following pointers should the going get rough:

Rainbow Six's planning phase is the backbone of a successful mission.

- Cover all entrances and exits, especially if you are escorting hostages or other mission-critical cargo. Just because a Hutu rebel wasn't there when you waltzed in doesn't mean he and his buddies aren't waiting to mow you down as you leave.
- If a particular team is in trouble, command it with the [pg up] or [pg down] keys. Computer-controlled teams often turn into Swiss cheese, wandering aimlessly into open fire.
- When outfitting your team with equipment, spread the wealth. If the mission calls for disarming bombs, give a few of your team members the appropriate equipment. Some of them might not make it to the bomb at all. The best offense is always good defense.
- Use your recruit reserves in the beginning missions. The first few missions aren't too difficult, but as the game progresses, you'll be glad you have some trained and highly capable soldiers on your flanks instead of a bunch of green recruits.

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Apple iMac

Not nearly as cool as it looks

iMac may appeal to neophytes, but anyone wanting to do more than surf will be sorely disappointed.

PLUSES
- Looks really cool
- Easy to set up and use
- USB keyboard and mouse

MINUSES
- No removable media
- Flimsy notebook CD-ROM drive
- Only 2MB of video memory
- Uncomfortable mouse
- Meager 4GB hard drive
- No PCI slots
- No internal drive bays
- No SCSI
- No AppleTalk
- No joystick port
- Difficult to get inside case
- No ROM for OS instructions

UNDER THE HOOD

THE BRAINS	
CPU	G3 233MHz
L2 Cache	512K
RAM	32MB
Motherboard	Apple Motherboard
Drive Bays	0
I/O Ports	Two USB, 10/100BaseT Ethernet, 56K modem, IrDA
DISPLAY	
Videocard	ATI Rage IIc (on the motherboard) with 2MB
Monitor	15-inch, 13.8-inch viewable, .28 dot pitch
Res/Refresh	1024x768@75Hz and thousands of colors
STORAGE	
I/O	EIDE on motherboard
Hard Drive	4GB Quantum Fireball SE
CD/DVD	Apple brand 24x CD-ROM built by Matsushita
Removable	None
SOUND	
Sound	Crystal chipset on the motherboard
Speakers	Generic, built into the machine

THE BUNDLE

Pangea Nanosaur | Mac OS 8.1 | Broderbund Williams-Sonoma Good Cooking | Quicken Deluxe 98 | Shiny MDK | MetaCreations' Kai's Photo Soap | AppleWorks (formerly Claris Works) | FAXstf | EarthLink Total Access | Microsoft Internet Explorer | Netscape Navigator | Outlook Express

BOOT 0:56 DOWN 0:03

iMac is the most hyped launch since Mac Plus freed the masses in 1984. But Apple shot its wad designing this all-in-one modern-art piece while cutting corners on most of the important components.

If the iMac represents the future of computing, its designers should have started with ergonomics. The transparent, one-button, hockey-puck USB mouse made our wrists ache after only 15 minutes and sorely lacks a scroll wheel. Likewise, the meager USB keyboard is uncomfortably angled and its cable is annoyingly short.

Equally uncomfortable is the sound from the iMac, proving this box should be seen and not heard. The tiny 1x1.5-inch stereo speakers distort any sounds played at any volume and the Roland software wavetable that lurches through the Cirrus Logic CS4211-KM sound chip (via QuickTime 3.0) made us long for the cloying sounds of FM synth.

The notebook-style CD-ROM drive isn't much better. While listed as 24x, this CAV drive delivers more in the ballpark of 14x, depending on where you read from the disc. We compared it's throughput to the 32x drive in IBM's Aptiva E3N (reviewed in the October 1998 issue). The iMac needed 4:03 seconds to pull 250MB from a disc; the Aptiva only took 3:10 to do the same.

Apple's making a statement by not including any form of removable media, such as a floppy drive. Got floppy backups or apps that require a floppy key to operate? Buy a $120 USB floppy drive. (Cha-ching!) The iMac desperately needs some form of removable media, such as a CD-R, CD-RW, Zip, Jaz, or Syquest drive.

And seeing as this paradigm-shifting machine is intended for families and schools, we're amazed at the lack of a DVD drive.

ATI's outdated Rage IIc chipset and its meager 2MB of memory are also a disappointment. The iMac's resolution maxes out at 1024x768 (compared to the Aptiva's 1600x1200). If you want to upgrade to better 3D graphics (for all the best PC games... once they port over to the Mac platform next year), forget it. There are no expansion slots inside the iMac, except the mysterious Mezzanine slot on the underside of the motherboard.

Want a joystick? Think USB ($45). (Cha-ching!) Is your printer or scanner USB-compatible ($60 adapter)? (Cha-ching!) Now you need a USB hub ($90) to hook up all this gear. (Cha-ching!) Apple's so USB-obsessed that it didn't even include support for its own (vastly superior) FireWire technology! In fact Apple left out all other connectivity options (serial, parallel, AppleTalk, ADB, even SCSI).

One of the few iMac components that can be upgraded is the RAM—from 32MB to a passable 128MB.

The corner cutting permeates even the smallest of details. Instead of a dedicated ROM, iMac uses the hard disk and swaps operating instructions to RAM. The OS uses as much as 3MB of RAM, leaving just 29MB to run your apps.

If the iMac is Apple's shape of things to come in personal computing, the future looks grim indeed. Sure, the $1,299 price tag may appeal to cost-conscious consumers, but when you add up the additional amenities, you're looking at a bottomline beyond $1,600 for a computer that's really not worth even the original asking price. Save the dough and buy WebTV.

—Rick Popko

MAXIMUM PC VERDICT

Price $1,299
Company Apple
Phone 800.538.9696
URL www.apple.com

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PUTTING iMAC TO THE TEST

To find out how Apple performs against a comparably priced PC, we pitted it against IBM's $1,250 Aptiva E3N (reviewed in the October 1998 issue), which uses AMD's 300MHz K6-2 with 3DNow!. Like the iMac, the E3N includes a 15-inch monitor.

THE METHODOLOGY

The graphics on both machines were set to 1024x768/16-bit.

The *Quake* test was conducted by running timedemo1 at 512x384 with 16-bit color depth. Scores are recorded in fps.

For the *Premiere* test, we dropped a cross-dissolve transition between a pair of 10-second 640x480 clips with no audio. In the make-movie properties, we set the output resolution to 1024x768, set our compression to "none" and set the framerate to 30fps.

For the *Photoshop* test, we took a 640x480 TIFF, blew it up to 5000x5000, applied a CMYK conversion, and finally applied a Gaussian blur to the image.

Using NewTek's *Inspire*, we loaded the raytrace.lws scene included on the disc and timed how long it took to render using the software's default setting.

REAL-WORLD BENCHMARKING

	APPLE IMAC $1,299	IBM APTIVA E3N $1,250
Quake (fps)	22.7	32.3
Premiere (make movie) (min:sec)	05:11	02:51
Photoshop (image resize) (min:sec)	01:19	01:10
Photoshop (CMYK conversion) (min:sec)	01:10	01:27
Photoshop (Gaussian blur) (min:sec)	01:24	01:13
NewTek Inspire 3D render (min:sec)	12:25	18:58

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

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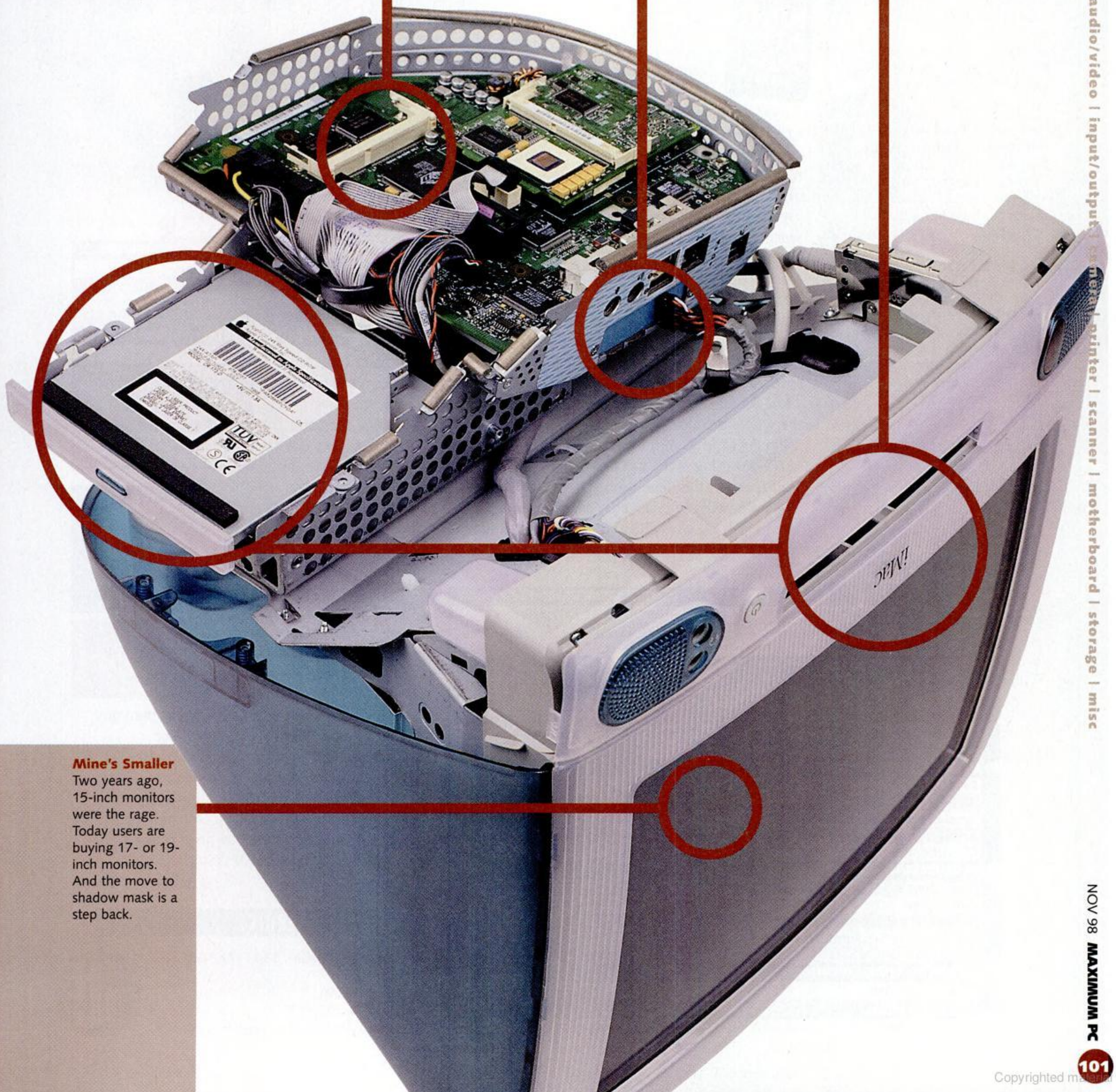
You wanna piece a me? It took 15 screws, four pieces of plastic, two people, four Band-Aids, and a full half-hour before we finally got to the heart of the oh-so-shy iMac.

Sorry, folks, no PCI slots here The mysterious Mezzanine slot, on the motherboard's flipside, was used during the development of iMac, but Apple has no plans to do anything with the iMac's only expansion slot.

It's my way or the highway If your peripheral doesn't do USB, you're stone-cold SOL. Along with the MIA FireWire, AppleTalk, and SCSI, the stand-offish iMac doesn't even have a serial port.

A notebook CD-ROM drive in a desktop? Parents, if you're not careful, this will be the first thing your child breaks. It doesn't slide out gracefully like most tray-based CD-ROM drives, and the laser mechanism is exposed when you pull it open.



Mine's Smaller Two years ago, 15-inch monitors were the rage. Today users are buying 17- or 19-inch monitors. And the move to shadow mask is a step back.

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SECRETS OF GIANT MAGNETORESISTIVE HEADS

Hard drive technologies continue to evolve, allowing for more data to be put into smaller spaces. Areal density refers to this technology and is measured in gigabits per inch^2 (Gbits/in^2). IBM started manufacturing hard drives with areal densities of 3Gbits/in^2 in 1996 and demonstrated drives using 5Gbits/in^2 in 1997. It's since shown, with the use of the Giant Magnetoresistive (GMR) head technology, that areal densities of 10Gbits/in^2 and up to 40Gbits/in^2 can be obtained. This means drive capacities ranging from 60MB to 200MB are on the horizon.

GMR is an advancement over the previous magnetoresistive (MR) head in that GMR heads have a greater sensitivity to magnetic fields from the disk. This makes it possible to detect smaller recorded bits and to read those bits at higher data rates. The larger signals also help overcome the electronic noise that plagued older drives.

The 14GXP currently has an areal density of 2.4Gbits/in^2 and is the first drive to use GMR technology. Expect the densities to increase from here, directly affecting drive sizes and performance.

IBM DeskStar 14GXP Ultra DMA Hard Drive

That's no moon, that's a space station!

MAXIMUM PC KICK ASS! product

IBM innovates more than any other hard-drive manufacturer, and it certainly let loose the dog of war with the DeskStar. Designed around Ultra DMA technology and housed in a small 3.5-inch formfactor, this monstrosity takes advantage of IBM's latest Giant Magnetoresistive (GMR) technology. The computer industry has used the 14GXP in consumer machines, garnering some of the highest benchmark numbers we've seen. The first system we reviewed that used this drive broke all IDE records to date, and every machine since has performed at that level, with none failing or causing the slightest headache.

The IBM DeskStar 14GXP delivers Ultra Wide SCSI performance at a fraction of the price.

The 14.4GB DeskStar 14GXP has a spindle speed of 7,200RPM and an available capacity of 13.4GB when formatted using FAT32. Formatting the whole drive capacity in a single partition using Fat32 in Win98 took just under 2 minutes; in NT 4.0 using NTFS it took 14 minutes. The read speed of this drive pushes close to 12MB/sec in Win98, with write speeds reaching 16MB/sec. That puts it on par with some of the faster Ultra Wide SCSI drives currently available. And due in part to the drive's Ultra DMA architecture, the CPU utilization is almost nil. But the most impressive score is the read burst speed that reaches a ceiling of 28MB/sec, almost saturating the Ultra DMA bus, which has a total bandwidth of 33MB/sec. Adaptec Threadmark, which tests hard drive thrashing and random data reads across the whole drive partition, also delivers an imposing score, one that other drive manufacturers aspire to reach. The only discrepancy we found was with the random access time, which was almost 3ms over the advertised spec. But it's still faster than any other IDE-based hard drive we've seen.

The 14GXP comes in capacities of 10.1GB, 12.9GB, and 14.4GB (at 512 bytes per sector), with the two largest sizes containing five disk platters and the 10.1GB size containing four platters. The performance-to-price ratio is awesome. Long live the DeskStar!

—Sean Cleveland

THE SPECS

MEASUREMENTS
630 grams
25.4mm height
101.6mm width
146mm depth
BUFFER SIZE
512KB
FEATURES
Write cache
Power saving modes
CHS and LBA mode
S.M.A.R.T. function support

PLUSES

- Built using GMR head technology
- Fastest IDE throughput we've ever seen
- Large capacity

MINUSES

- Random access time doesn't meet spec

REAL-WORLD BENCHMARKING

	IBM DESKSTAR 14GXP	
Operating System Tested Under	Windows 98	Windows NT 4.0
Interface	Ultra DMA (ATA-4)	Ultra DMA (ATA-4)
Spindle Rotation Speed	7,200RPM	7,200RPM
HD TACH BENCHMARKS*		
Average Read Speed	11.8MB/sec	10.7MB/sec
Average Write Speed	15.7MB/sec	14.3MB/sec
Random Access Time	11.7ms	13.3ms
Read Burst Speed	28.1MB/sec	28.7MB/sec
CPU Utilization	4.2%	3.1%
INTEL IOMETER RANDOM DATA TESTS		
Read Speed	N/A	9.1MB/sec
Write Speed	N/A	6.7MB/sec
Average Read Response Time	N/A	110ms
Average Write Response Time	N/A	286ms
CPU Utilization	N/A	1.2%
SEQUENTIAL DATA TESTS		
Read Speed	N/A	12.7MB/sec
Write Speed	N/A	10.5MB/sec
Average Read Response Time	N/A	79ms
Average Write Response Time	N/A	190ms
CPU Utilization	N/A	1.4%
ADAPTEC THREADMARK		
Data Transfer Rate	6.77MB/sec	7.40MB/sec
Average CPU Utilization	29.4%	9.78%

*Performs a full benchmark assault on hard drives.

MAXIMUM PC VERDICT

Price $455 (14.4GB), $349 (12.9GB), $275 (10.1GB)
Company IBM
Phone 800.426.7777
URL www.storage.ibm.com/storage

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"The first word that comes to my mind when describing NVIDIA's new TNT 3D graphic accelerator is WOW! The visual quality and frame rates...were astounding."

—Maximum PC, www.maximumpc.com

"...performance was better than any 2D/3D combo card I've seen. On top of that, games like Quake II and FLIGHT SIMULATOR 98 looked spectacular at 1024x768 and 1280x1024 (respectively)."

—Computer Gaming World, September 1998

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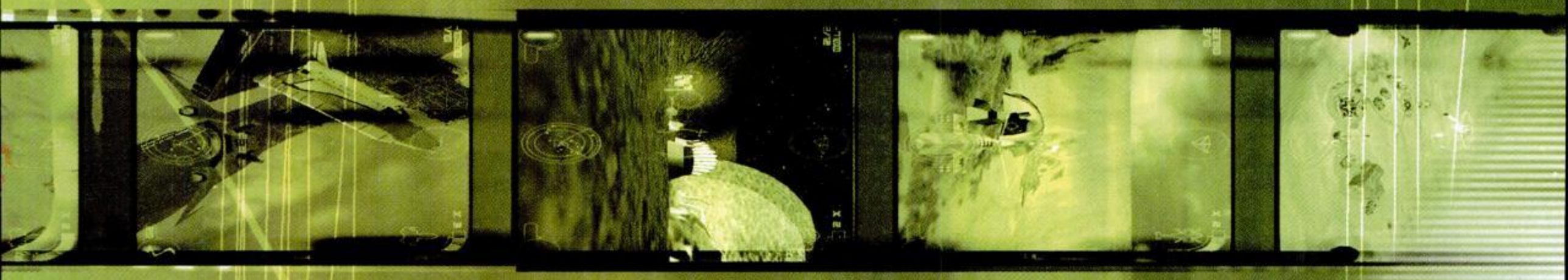

"...performance so extraordinary it will change the next generation of games."

"Imagine Quake II at 1600x1200 at over 30fps. Imagine DeathMatch Quake II at 1600x1200 — you can see the other guy before he sees you. The TNT will likely be the hot ticket in AGP cards in the near future."

—Computer Gaming World, September 1998

"A true 'supercard'...offers complete 2D and 3D compatibility, as well as the best Direct3D performance available...gaming will never be the same at resolutions of 1024x768 and above."

—Adrenaline Vault, www.avault.com

- RIVA TNT™ 128-bit 3D/2D and video accelerator
- 16MB of memory for resolutions up to 1920x1200
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- Windows 95, 98, NT and OpenGL support
- Lifetime warranty and unlimited toll-free support
- Available for AGP and PCI bus

"...competing in an arena with the likes of the Savage 3D, Banshee and G200. All of these it will beat handily...they are the Kings of the 2D/3D combo card!"

—RivaZone, www.rivazone.com

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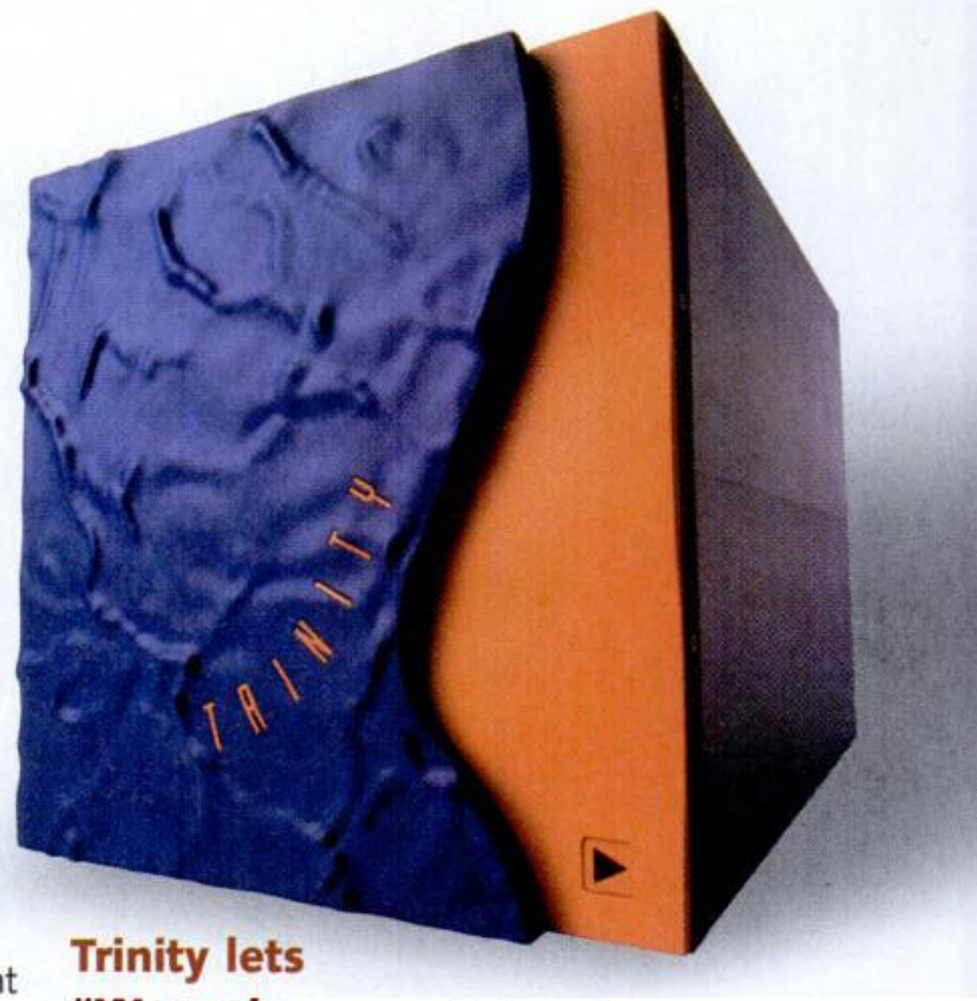
Play Trinity

It's a toaster killer



Trinity lets "Wayne's World" wannabes produce broadcast-quality television shows out of their garage.

THE SPECS

REQUIREMENTS

Intel Pentium/II/Pro (166MHz or faster)
Windows NT 4.0
64MB RAM
1.5GB hard disk space
CD-ROM
Standard 1024x768/ 24-bit SVGA display

PLUSES

Machine control is accurate and responsive
Plenty of right-mouse-button shortcuts
Special effects better than Toaster
Can link multiple Trinities together
Built-in BBC
Impressive software tools
Drive-bay room
Eight warp engines fit in box

MINUSES

Deceiving entry-level price tag
No third-party developers yet
Some key effects quickly become cliche
Render delays for some live effects
Some effects will require more than 16MB RAM
Clip Mem effects grainy
Can't tweak 3D effects

At long last, Trinity has arrived. This all-in-one, rack-mountable, video-production unit from the developers of the original Toaster/Flier includes a character generator, a 2D motion-graphics module, a live eight-channel switcher, and paint/compositing tools. Trinity is a fully customizable video production box for A/X, A/V, and sync-roll editors. But it does not yet do hard-disk-based nonlinear capture and editing.

Built from the ground up with early help from Microsoft and Intel, the box is packed with 22 custom chips and one million lines of code—which explains why it the release slipped four years. Trinity attaches to a standard Windows NT PC (not included) via a high-speed digital serial link called VideoNet. The VideoNet card, which takes up one PCI slot in the host PC, supports up to 500-foot cable lengths without introducing data degradation.

To test Trinity, we enlisted Jerry Gainor, Stuart Sweetow, and Brendan Ryan, a team of editors (and current Toaster users) at Audio Video Consultants, an Oakland, CA–based video postproduction shop. They supplied the decks, cameras, waveform monitor, numerous man-hours, and source material.

The standard internal cards include the Warp Engine, the Frame Store, the Switcher, and the Coordinator Card. All video-processing cards can handle D1 720x486 broadcast-quality video in realtime. The PCI slots in the back hold your video input and output modules, which are sold separately. You can have up to eight live inputs and four outputs. Nice touches include plug-and-play hardware recognition and a small light on each of the cards that indicates whether it's working. Each card has a built-in hardware color corrector that can be programmed through software or changed on-the-fly. Like your video I/Os, audio is sold separately. The mix software includes a three-band parametric equalizer, pan, fade, solo, and mute. Another "extra" is the Clip Grab card, which lets you view two sources of video on your VGA monitor.

Another nice touch is ClipMem, a utility that captures uncompressed D1 video into the Warp Engine's RAM—128MB of RAM will hold roughly 6 seconds of video. That video can then be brought into *Panamation* (Trinity's painting application) for further manipulation.

While Trinity's hardware is certainly impressive, the software suite ties the whole package together, with *Switcher*, *Panamation*, *TitleWave*, *PersonalFX*, and *Preditor*.

With all these tools at your disposal, it's easy to accumulate new effects. All images/effects you create are represented with picture icons and stored in bins. But remembering which bin you saved a particular effect to can be confusing. We'd like to see a search tool incorporated that lets you find an image/effect anywhere in the system. We appreciated the ability to save a complete linear edit in the bin with a picon representing the first frame.

The Graphic Content and Project guide has tutorials to get your through most of the features and functions, but these tutorials only gloss over the power of what this machine can do. For example, the realtime chroma key—one of our favorite features—only has a few scant pages dedicated to it.

To check broadcast conformity, we hooked Trinity up to a waveform monitor and played color bars though it. It passed with flying colors (+105 ire in the white/-40 in the black, and all the colors hit their corresponding squares).

Trinity is the broadcast answer linear editors have been waiting for. And since Play recently merged with Electric Image, expect to see new features such as interactive virtual sets and better 3D integration with the Trinity software in the future. If Play hadn't incorporated hidden audio and I/O costs into its machine, Trinity would have garnered a Kick Ass award.

—Rick Popko

MAXIMUM PC VERDICT

Price $4,995
($13,175 as tested)
Company Play Inc.
Phone 916.851.0800
URL www.play.com

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Preditor is your realtime time-line-editing interface where you arrange your composition, color correct or composite independent clips, tweak audio, and control decks.

The Switcher mixes up to eight video sources and two still stores in realtime, in full D1 resolution. The card also performs dissolves, fades, color correction, and organic wipes.

TitleWave is a realtime, anti-aliased character generator that lets you roll, crawl, reveal, and flash text on or off screen. It supports all TrueType fonts.

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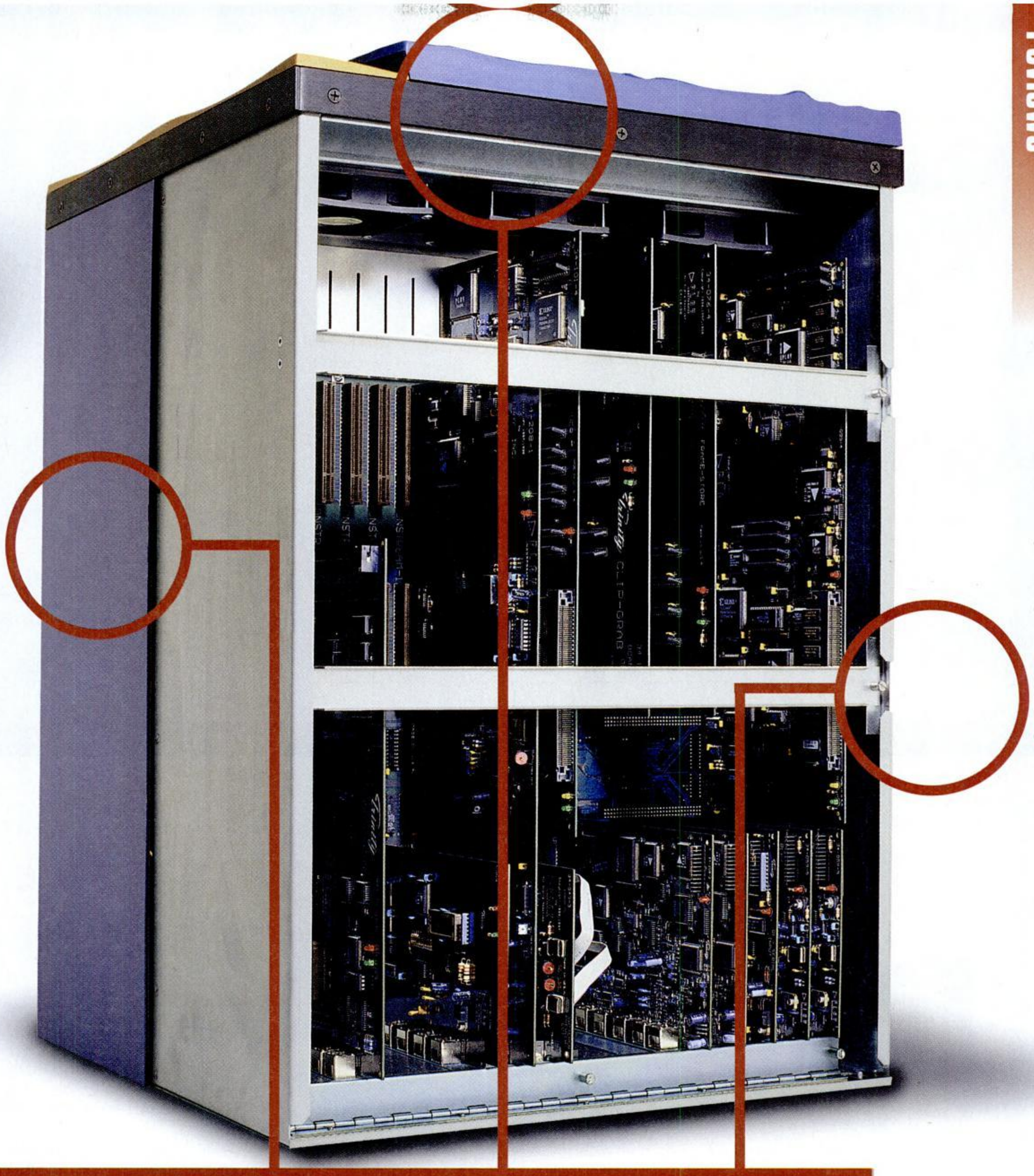
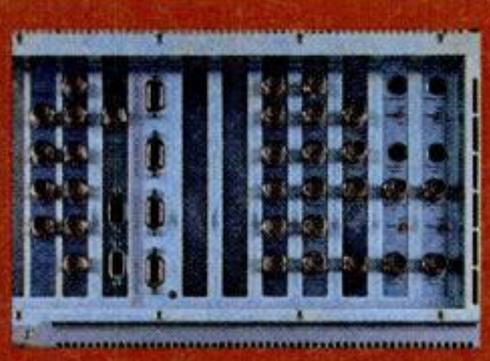
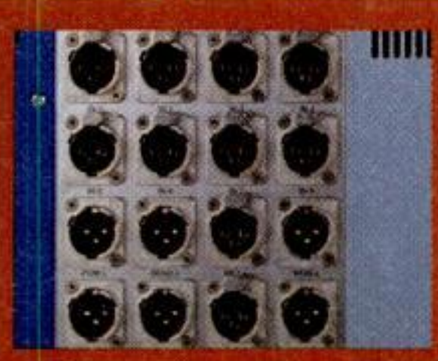


Panamation is a realtime, object-oriented paint, animation, and compositing tool that lets you paint directly on video with variable transparency.



From left to right, the back of the machine shows your output modules, RS-422 control, and video-input modules. You can mix and match composite, component, and SDI modules.

The front space inside Trinity houses your drive bays. Here you can store CD-R, A/V, and tape backup drives. Unfortunately, there are no rail separators to properly mount such media devices.



Audio in/outputs aren't included in Trinity's base price. You can add eight RCA inputs and two outputs, or eight balanced inputs and two outputs—for a price.

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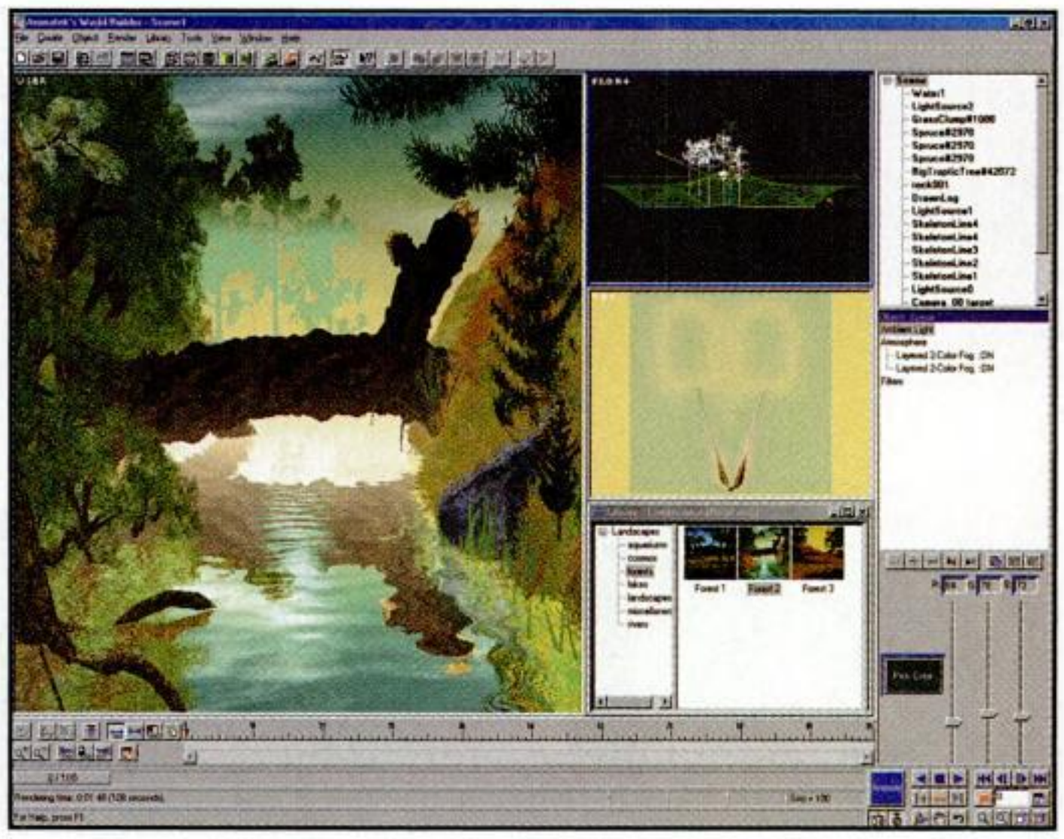
World Builder Yosemite Edition

Buena vista

MAXIMUM PC KICK-ASS! product

Create your own private Idaho with the latest incarnation of *World Builder* terrain modeler and rendering software. Originally a DOS application (gasp!), *World Builder Yosemite Edition* (WBYE) finally meets Windows 9x and NT, and brings with it a new interface and a slew of features.



This powerful 3D-terrain generator works on the principle of skeletal lines. Rather than extruding shapes from basic polygon primitives (a time-intensive process that yields artificial landscapes), you create worlds via skeletal lines, which form the basis of mountains, valleys, and vistas. To envision what a skeletal line is, look at a mountain profile—that curved shape forms the backbone of a *WBYE* mountain. *WBYE* automatically determines how the slopes of the mountain will fall, resulting in a more natural look. Of course, you can intersect skeletal lines to control your mountain. *WBYE* then fills in a topographic mesh of your terrain. Your flat-, gouraud-, or phong-shaded worlds can be rendered in individual graphics files or saved as an animation.

The interface may be rigid, but World Builder Yosemite Edition packs lots of terrain-rendering horsepower. This scene was created with one drag-and-drop operation.

The variety of plants and grasses that can also be added astounds. Did we mention practically everything, including terrain textures, is tweakable?

Make no mistake about *WBYE*—it's no *Bryce3D*, with its foo-foo squishy globular interfaces. *WBYE* is a hardcore 3D app, with a multiwindow interface.

WBYE has two extreme rendering methods. The simple way uses any of the prefab libraries of skeletal landscapes packaged with the program. Open a landscape library, pick one, then drag-and-drop the icon onto your viewport, and voilà—instant world! Place a camera and some lighting, and you've just made your first world. Add skies, oceans, and rivers the same way.

The second, more time-consuming (but more powerful) modeling method involves laying down skeletal lines and tweaking them. You'll spend much time learning the program's nuances, and here, the learning curve is steeper than the north face of Half Dome. It took us hours just to get the hang of the interface, and even more to start learning its fine points. But the gorgeous renders, complete with atmospheric fogging, semi-transparent and reflective waters, and lush greenery, make it worth the effort.

While *WBYE* offers many more animation options than its predecessor (including a much-needed Camera collision detection), its code allows multithreaded processing and easier network rendering. *3D Studio Max* is integrated via a communication plug-in, allowing simultaneous sessions of *WBYE* and *Max*.

Regardless, you'll need a powerful rig if you want to churn out otherworldly scenery quickly—a large Phong preview on a 350MHz Pentium armed with 256MB or RAM took a good nine minutes!

There's so much to see and do with *WBYE*, it could become an obsession. If you want to create your own awesome landscapes for game development, graphic design, or computer animation, *World Builder Yosemite Edition* will have you feeling Divine.

—Andrew Sanchez

THE SPECS

REQUIREMENTS

- Pentium processor
- Windows 95/NT
- 32MB RAM
- 40MB of hard drive space
- 800x600/64K color display
- 4x or better CD-ROM

PLUSES

- Win 9x/NT native means easier network rendering
- Multi-proc ready
- Excellent rendering quality
- Almost unlimited scene adjustment
- Works with 3D Studio Max
- Two modes of modeling

MINUSES

- Steep learning curve
- Fast renders require muscular system

MAXIMUM PC VERDICT

Price $999
Company AnimaTek
Phone 800.471.1233
URL www.animatek.com

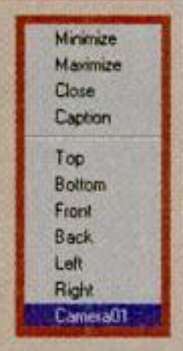
9

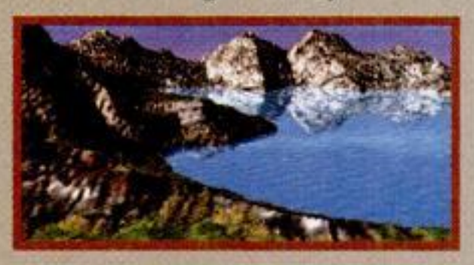
CREATE HELL ON EARTH

Here's how to change clear water into a river of blood.

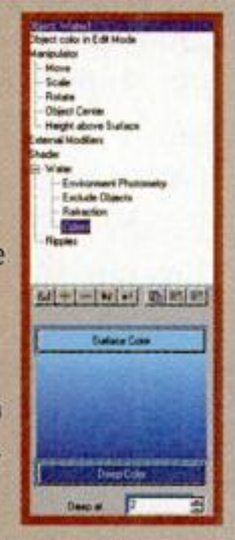
▶ Create a new landscape. Go to the scenery library, click on Lakes, and left-click drag-and-drop Lake3 into your viewport.

▶ Position your cursor at "Top" and right-click to change the viewing angle—choose Camera01, then click on the Phong rendering button. You'll see the following scene with clear water. Let's get bloody!





▶ Look at the top-most structure tree and under Scene, left-click on Water01 to see its attributes. Under Shader, single left-click on Water, then click on Colors. You'll see a color palette showing a gradient that controls the water's color at the surface and down deep.



▶ Click on Surface Color to get the Color Palette. Choose a suitably bloody color. The surface color is now blood red gently gradating to blue. To change this, press the Deep Color button to get the Color Palette menu again. Choose a deep, dark, shade of crimson.

▶ Now, click the Camera01 view and the Phong render button.

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Aerial Assault

Kickin' ass from the skies

Remember when the coolest thing going in aerial assault games was the likes of *Chopper Commander* and *Battle Isle*? Now look what those pesky developers have gone and done, piling on graphics galore and nifty new features to some trusty old gameplay, all in loving 3D splendor.

Who knew? This month we jump behind the stick of three hot airborne games that really kick in the texture afterburner and take us on a ride in the way-back machine. So please stow your tray tables and make sure your seatback is secured in the upright and locked position, and be certain to inform your flight attendant of any in-flight sickness bags that may need disposal, 'cause this baby's coming in.

—Phil Lacefield Jr.

Incoming

Incoming sports what has to be the loveliest 3D accelerated graphics this side of...well, um, we're still looking. 3D cards have become commonplace in today's gaming world, and nowhere will you see a better payoff than on these fields of battle.

All the tricks are here in living color, just as you'd expect from a title with such a heavy emphasis on graphics. Your brain will simply faint dead from the plethora of explosion rings, lens flares, mip-mapped terrain, transparencies, and high-polygon-count buildings and vehicles. Details are consistently crisp and clear, featuring gorgeous skies and never-ending horizons devoid of "pop-up" mountains in the distance. Framerates remain high up through 1024x768, but be prepared with a screaming P-II and lots of RAM.

Oh yeah, gameplay. Or what passes for gameplay. Seems your CPU will be so burdened with its visual load that it can't be bothered with such trivial details as physics and flight modeling. The premise is pretty simple: save Earth from invading aliens that pour in *Galaga*-style. Arcade and scenario play sit you behind the controls of everything from a Harrier VSTOL jet to a captured enemy fighter, with every tank and turret in between. Variations on the classic realtime strategy game interrupt a consistent flow of shoot-'em-up scenarios, which is where the real fun is. Control is simplistic and minimally intuitive, but that didn't keep us from playing for hours on end, day after day. Which is exactly what you'll find yourself doing with *Incoming*, even if it's just to crash and burn so you can witness again the beautiful fireworks.

Yeehaw! 500 extra points for blasting the cute little Mars **Explorer rover into dust.**

MAXIMUM PC VERDICT

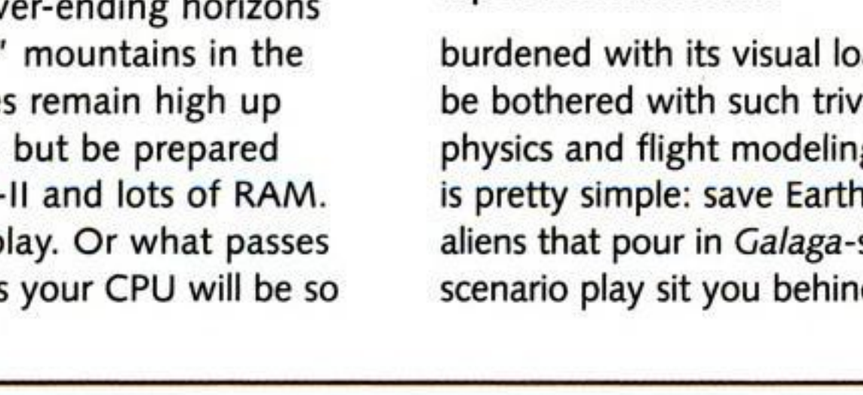
Price $50
Company Rage
Phone +44 (0) 151.933.2688
URL www.rage.co.uk

8

Urban Assault

Combine *Starcraft*'s endless meandering drones and Marines, the arcade numbness of *Incoming*, and the wickedly nasty mech battles of *MechCommander*, and you'll get Microsoft's *Urban Assault*.

Urban Assault lets you command big chunks of machinery and make lots of little military assault thingies, all while searching for energy to build more military thingies to use in a final battle to save Earth from alien meanies and religious wackos. Sound familiar? It should, if you've sat behind the controls of *Battlezone*. While not a blatant rip off (hi-res 3D rendering is gorgeous, and the transparent battle maps are cool), you get the feeling you've worn this overcoat before. Clicking on thin air procures jets, tanks, choppers, and turrets aplenty—as long as the energy holds out. When you're not busy slugging it out mano-a-mano, you're out collecting plasma and capturing energy sites from the baddies. Pretty, but nothing to run off and join the LAN-party circus over.



Blue sky, pretty clouds, and lots of skyscrapers to blow up.

Fortunately, *Urban Assault* puts on a pretty show. High-poly vehicles meander through destructible cities and terrain in vivid 800x600 res, blowing up everything in their path, although trees and forests are sorely missed in the scintillating hardware-accelerated game world. Who knew Europe had been reduced to a barren plain? But missions are well thought out and sometimes difficult. A nifty feature is the ability to take some units with you from mission to mission, providing the winning edge in some campaigns. Unfortunately, the cut scenes repeat the same theme over and over, leaving you with the nagging feeling that the future has no sense of humor. IPX multiplayer support makes things more interesting, but man what a dreary place to hang!

The heady mix of tactics and strategy in *Urban Assault* gives even the most jaded realtime strategy gamer a new lease on life, but like all quick fixes, this one will let you down with a nasty splat.

MAXIMUM PC VERDICT

Price $50
Company Microsoft
Phone 425.637.9308
URL www.microsoft.com/games

6

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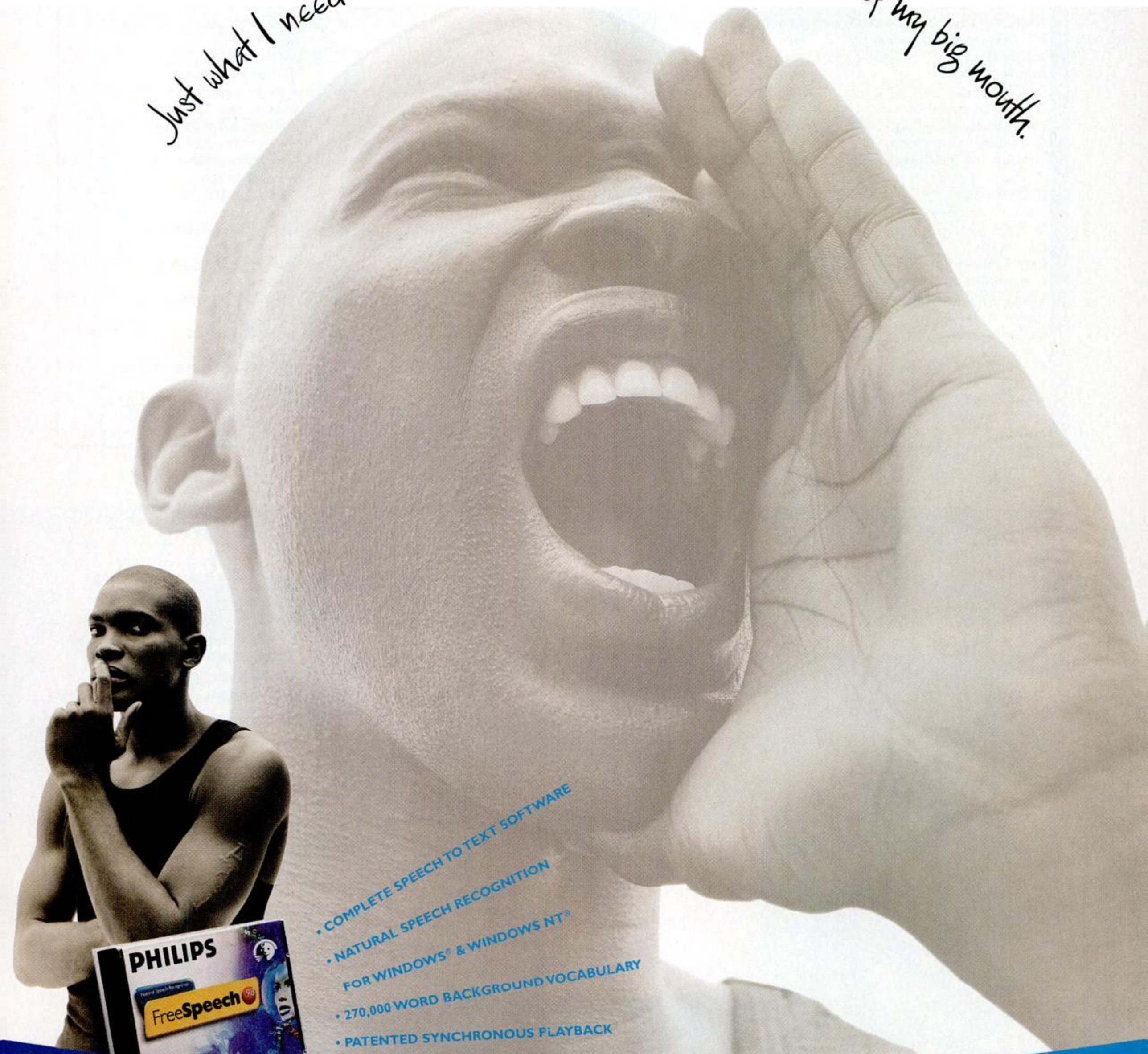
Just what I need—software that lets me make the most of my big mouth.



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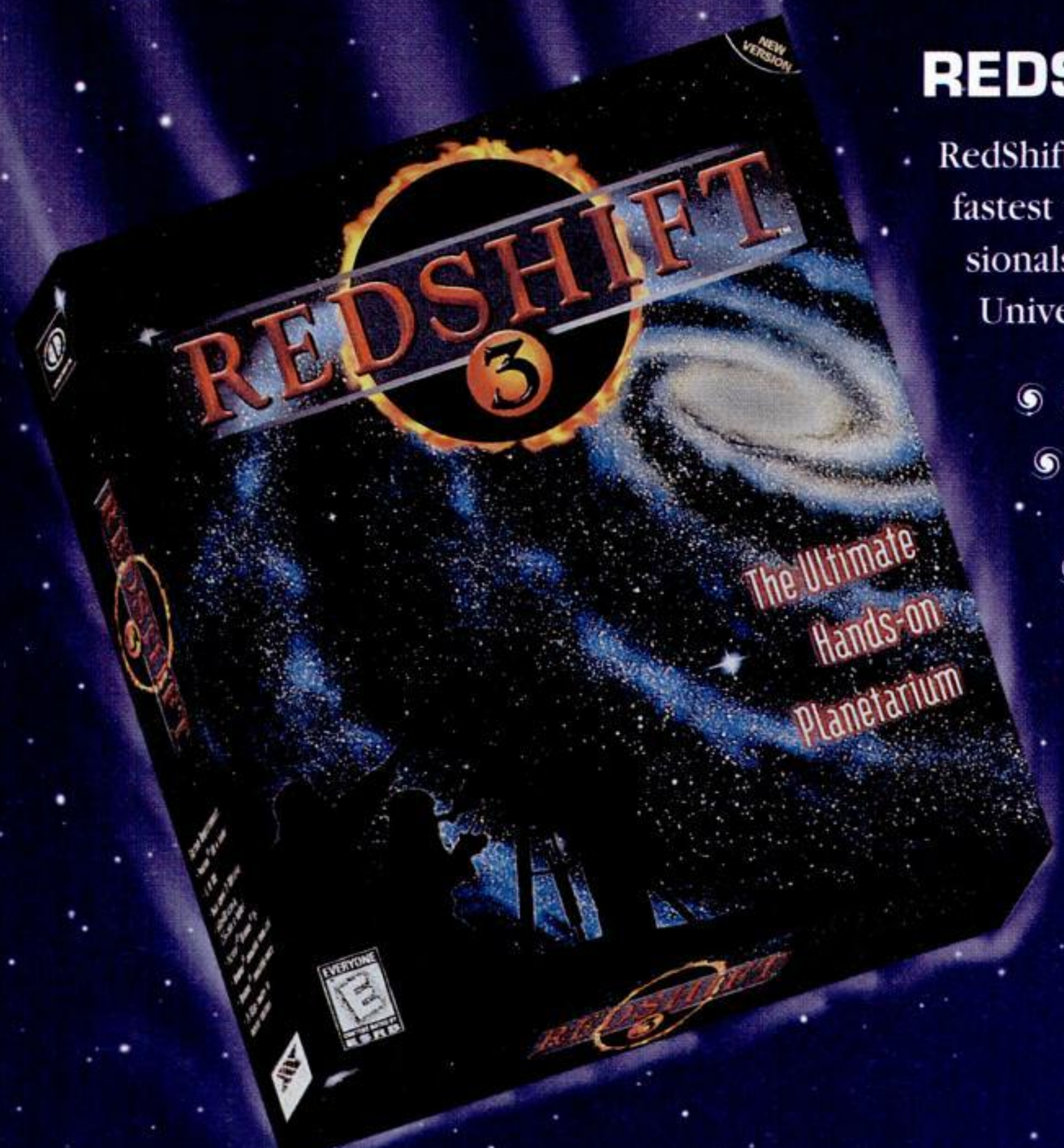

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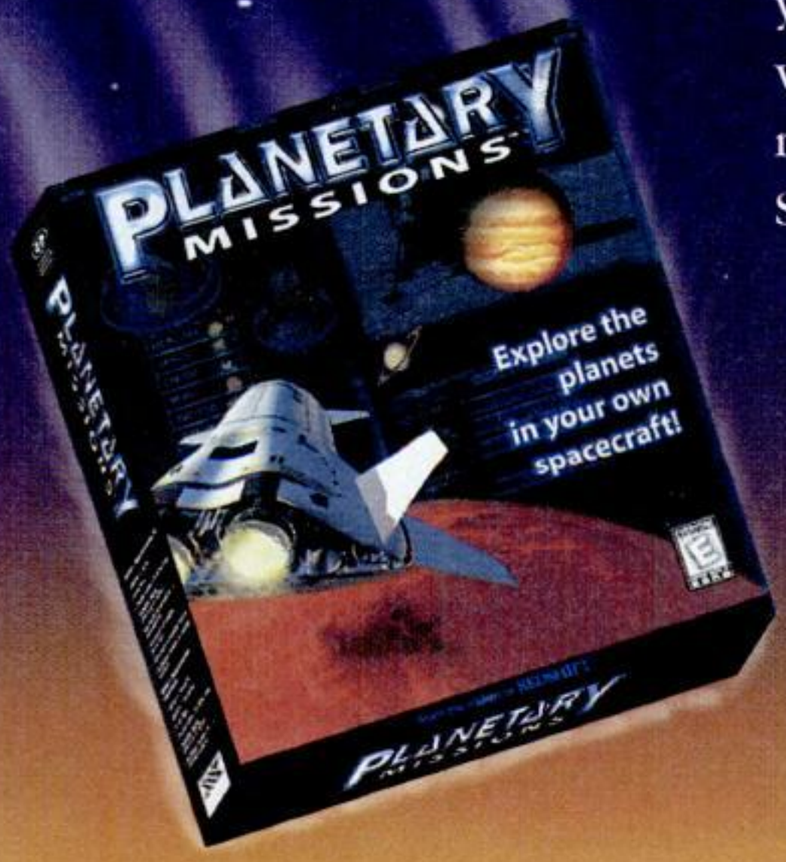

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MARIS

Commercial

Multimedia Speaker Systems

The desktop is alive, with the sound of fragging

D iggable desktop harmonics is the latest battlefield on which vendors are plying their wares.

Once ignored by system manufacturers, speakers engineered specifically for computers are now an essential part of your digital audio experience. Because no matter what kind of fancy-fresh A3D/EAX soundcard rumbles under your PC's hood, it'll sound like muskrats marching through mashed potatoes without the proper speakers backing you up.

Here's the latest in computer speakers technology.

—Andrew Sanchez

Thinner than Kate Moss on a diet, the Monsoon MM-1000 planar-magnetic speakers sound almost angelic.

Monsoon Sound MM-1000

Monsoon, known for high-end car-audio speakers, has whipped up a thin and sexy computer speaker system in the form of the MM-1000.

The centerpiece of this three-piece subwoofer/satellite combo are the 4x8-inch desktop speakers, which pack some interesting technology.

Unlike conventional paper-cone speakers, the MM-1000's satellites rely on planar magnetic design. Similar to electrostatic speakers, a planar magnetic speaker's diaphragm contains conductive strips that line up with magnetic strips located on the front and rear plates. Reaction between these and the resulting magnetic field forces the diaphragm to move, creating sound.

Another unique feature of the MM-1000 satellites is their dipole-radiating design. Most speakers use a monopole design—a speaker (or group of speakers) lined up on a single (mono) axis and firing in the same direction. A dipole-radiating design has speakers facing away from each other. The rear-firing speaker is wired out of phase from the front speakers and is indirectly heard.

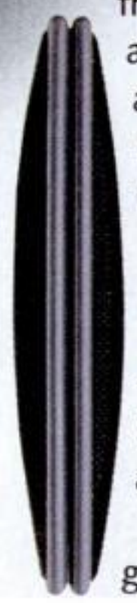
The 5.25-inch subwoofer (which gets frequencies below 200Hz) sits behind a metal grill in a bass-reflex/ported enclosure tuned to 53Hz. The amplification and active crossover elements sit inside the box, with 25 watts flowing to the subwoofer and 12.5 watts going to each satellite. Sitting atop the box is a master and bass volume knob and bass-punch button, which boosts 55Hz signals by 6dB.

Monsoon also provides a mini-puck that houses a remote volume control and mute button.

Planar speakers are known for clarity, and the MM-1000s are no exception. Delicate treble and female vocals dripped from these satellites like honey, although some folks not accustomed to metallic drivers may complain about a slight harshness to the treble. Center-channel imaging is spot-on, with vocals locked down front and center. The dipole nature adds an airiness to the soundstage, although they will be affected by nearby objects. Don't expect any warm midbass, though.

Bass tones are punchy and accurate, but lacked uber-low-end response. The biggest problem, though, is that enough bass gets into the planar-magnetics to cause an audible snap at loud volumes.

If Monsoon could fix this glaring audio error, the MM-1000 could be the smooth operator your desktop computer is looking for.



Both sides of the MM-1000's satellites emit tunes and tones, resulting in rich sound.

PLUSES
- Exquisite midrange and treble response.
- Imaging and center-stage excellent
- Near-field listening design means very good desktop sound
- Thin and sexy design requires minimal desktop space
- Tight, articulated bass

MINUSES
- Nasty metallic ringing noise when bass kicks in through satellites
- Very position sensitive
- Lacking deep bass

MAXIMUM PC VERDICT

Price $219
Company Monsoon
Phone 877.722.8946
URL www.monsoonpower.com

7

SUBWOOFER DOS AND DON'TS

Coaxing the best out of your bass box is one-part science, one part mysticism. Here are a few pointers on how to get the bump back in your trunk.

DON'T:

- Sit your subwoofer out in the open without any type of sound reinforcement from the surrounding environment, you'll lose up to four times the bass response you could get if you properly position it.
- Block the subwoofer's vent. Speaker manufacturers tune their bass boxes to a specific frequency to help optimize your bass sound. Plugging up or blocking the vent changes the bass box's sonic characteristics, and will put unneeded strain on the woofer, potentially destroying it in the long run.
- Overdrive your woofer by playing source material that causes the speaker to audibly bang around emit a snapping noise. Overdriving a woofer causes the voice coil—the wire electrical current pumps through—to fly out of the gap (the thin area where the voice coil sits close to the magnets). If the voice coil doesn't land correctly back in the gap, it might bang against the metallic sides, causing a short circuit and destroying the speaker.

DO:

- Try to corner-load your woofer. Place the woofer into a corner of your room, or at the very least, up against the wall. Bouncing the bass around the walls of your room will amplify your output.
- Aim your woofer away from you. Firing your bass into a corner or into a wall or floor (a process known as mass loading) often helps deepen bass response.

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Cambridge SoundWorks PCWorks FourPointSurround

With Sound Blaster Live and the MonsterSound MX-200 working that four-speaker surround-sound mojo, those wacky folks over at Cambridge SoundWorks have busted out just the solution for the two-speaker blues—the PCWorks FourPointSurround.

Based on the PCWorks three-piece subwoofer/satellite, the FourPoint-Surround, as the name suggests, adds two more 3x3x3-inch mini cube satellites to the mix. The rear speakers are mirror images of the front two-inch cone speakers, which are housed in sealed cubes. Also included in the package are 12-inch-high plastic stands for the rear speakers—they get the job done, but they're flimsy. Shielding on the front speakers proved to be inefficient, causing visible on-screen distortion when placed next to a CRT.

The bass retains its PCWorks heritage, with a 5.25-inch woofer mounted in a vented box. The big difference is in the I/O department. Sitting in the rear of the box is a bevy of RCA and 1/8-inch mini cable connectors for front/rear inputs and outputs. The remote volume knob controls all the speakers simultaneously—too bad there's no separate volume control for front and rear levels. Also, the power cable is still a fat brick and a half on the plug end. The woofer gets 10 watts, while 3.5 watts goes to each satellite.

Mate your favorite front/rear soundcard's outputs with Cambridge SoundWorks' PCWorks FourPointSurround—it's all ready to rock.

Listening to the FourPoint-Surround system, you'll start yearning for a bit more amplifier power. At low and medium volume, these speakers sing, but crank it up really loud, and the distortion starts to creep in (as expected). Regardless, imaging and clarity on the FourPoint-Surround never wavered, with an unusually strong midbass presence audible in the satellites. Bass with this 5.25-inch woofer is best served in a corner. Like the others in this roundup, don't expect to demolish your den with low frequencies.

Fix the magnetic shielding problem, and these speakers may have a chance in this growing multi-speaker battlefield. At the suggested list price, it's hard to say no, especially with that four-speaker soundcard sitting in your rig.

PLUSES
- Four speakers plus subwoofer for under $100
- Excellent sound at low and medium volume levels
- Speaker stands included for rear surrounds

MINUSES
- Weak magnetic shielding
- Low power may not satisfy the ground-pounders
- Major distortion at loud volumes

MAXIMUM PC VERDICT

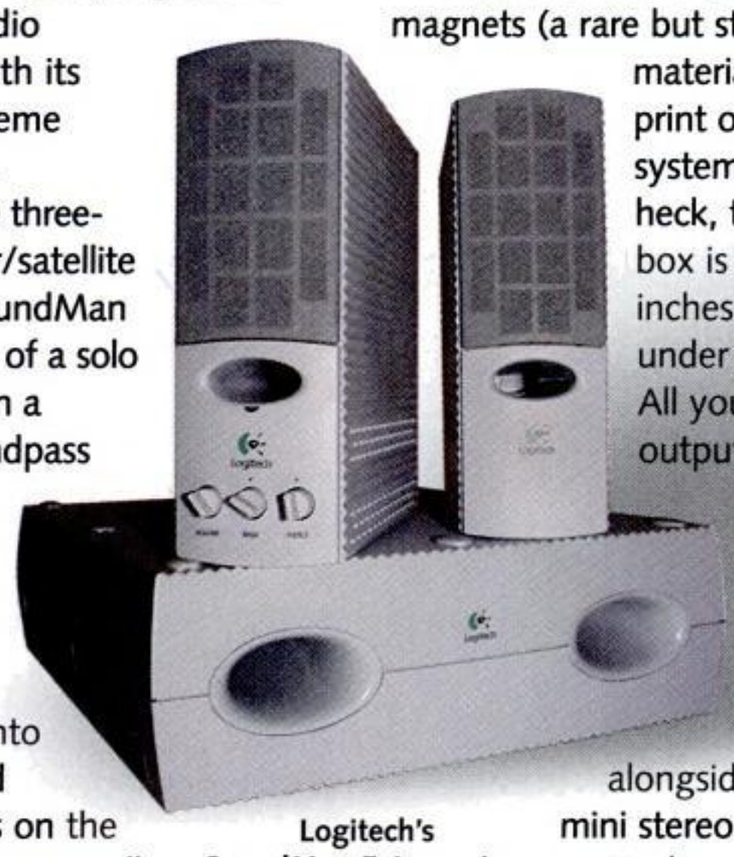
Price $99 ($149 when bundled with Creative Labs Sound Blaster PCI 128)
Company Cambridge SoundWorks/Creative Labs
Phone 800.0367.4434
URL www.hifi.com

6

Logitech SoundMan Extreme

Turning the I/O table, Logitech is entering the audio output arena with its SoundMan Extreme speaker system.

Following the three-piece subwoofer/satellite scenario, the SoundMan Extreme consists of a solo woofer housed in a single-reflex bandpass enclosure (a configuration where a woofer sits inside a sealed box and fires its output into a second, ported box). Twin vents on the side of the box output all the bass into your listening environment, while a 2x3-inch cone driver mounted in a pair of ported enclosures takes care of the mids and highs. Master volume control, as well as bass and treble equalization, sits on one of the satellites—always a good thing. Each satellite gets 12.5 watts, while 25 watts is pumped to the subwoofer.



Logitech's SoundMan Extreme is a welcome surprise to the multimedia speaker field, and its first time out is a good one.

Thanks to use of Neodymium magnets (a rare but strong magnetic material), the footprint of the speaker system is petite—heck, the subwoofer box is only 9x11x3.5-inches and could sit under your monitor. All your inputs and outputs are on the sub box, with a phone-cable-type connector for the satellites' audio controls sitting alongside your 1/8-inch mini stereo inputs.

Under our audio benchmarking bombardment, the SoundMan Extreme handled surprisingly well. The satellites take a bit of bass, but thanks to the enclosure design, handle it gracefully. Also designed as a near-field response speaker system, the SoundMan Extreme's center-channel imaging is very clear and present.

We tested bass output both on the desktop and in a corner-loaded situation, and the results may surprise you. Due to the filtering nature of a band-pass enclosure, subsonic frequencies below 20Hz shouldn't be expected, as bass rolled off below 40Hz. At 60Hz, there was a fair amount of wind-noise issuing from the vents, but overall bass response was smooth and controlled. Under *Quake II* and *SiN*, the SoundMan Extreme kept pace with the other systems in this roundup, breaking up only under the most extreme bass circumstances.

Considering Logitech's newbie status, we were expecting the worst. But thanks to some tight engineering and attention to sonic detail, the SoundMan Extreme is a fine first outing.

PLUSES
- Excellent overall sound quality
- Strong midbass from small satellite speakers
- Small subwoofer box can be put anywhere

MINUSES
- Bass output will leave ground-pounders unhappy

MAXIMUM PC VERDICT

Price $149
Company Logitech
Phone 800.231.7717
URL www.logitech.com

8

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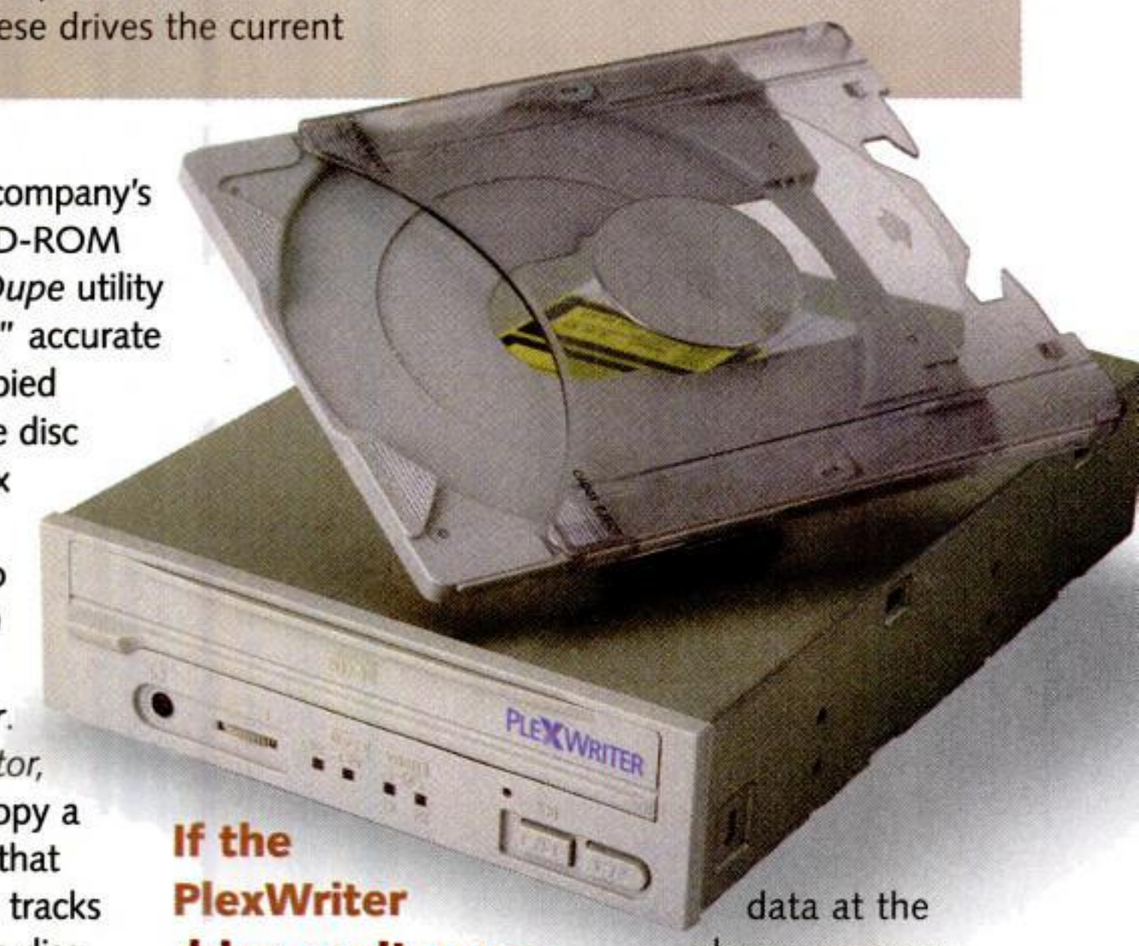
4x12 SCSI CD-R Drives

The best burners for your buck

Nothing beats getting top-notch equipment that performs like these 4x12 CD-R drives from Plextor and Teac. Running on SCSI-2 technology, both drives are efficient, fast, and impossible to disrupt, even when burning at quad-speeds. While read speeds are still not up to CD-ROM caliber, the write speeds and burn quality make these drives the current top of the heap... at least until Sony's and Hewlett-Packard's 4x24 drives arrive.

—Sean Cleveland



Plextor PlexWriter

MAXIMUM PC KICK-ASS! product

The PlexWriter is home to several killer features we've never seen in any other drive and includes the innovative *PlexManager* software that allows you to fine-tune your burning experience, from audio extraction to drive spindown.

The drive uses SCSI-2 technology to make the write process an efficient operation that's virtually impossible to disrupt. The built-in media-recognition circuitry recognizes different types of CD-R media and adjusts the laser for optimum power and length of burn. This takes media quality out of the burn equation, so all you have to worry about is maintaining a steady flow of data. Packet writing is the PlexWriter's biggest shortcoming; the drive fails to write at full-speed potential.

The included *PlexManager* software slaps a mean gauntlet when paired with the company's UltraPlex 32x CD-ROM drive. The *DiscDupe* utility does "bit-by-bit" accurate copying that copied our mixed-mode disc benchmark at 4x in 18:31min. Compare that to the Teac's 20:10 minutes using *Easy CD Creator*. Unlike *CD-Creator*, *DiscDupe* can copy a Playstation disc that contained audio tracks and a Macintosh disc with no problem.

With all the advances in the Plex Writer's write engine, we can forgive the CAV-based read engine that fails to deliver the full 12x potential except on outer tracks. While the drive doesn't match the Teac's speedy read rates, it still delivers a constant spew of data at the above-average rate of 1.5MB/sec.

If the PlexWriter drive can't copy your disc or data, then no drive can.

The kit includes an Adaptec 2930 PCI SCSI host adapter, Adaptec's full suite of software, and a few blank discs. The PlexWriter requires a caddy, although a unique tray that pulls forward is included, making the drive seem like a tray-loading drive.

Plextor has packed a lot of innovation into its newest thoroughbred, and it shows. We ran the PlexWriter hard from day one and never once had a bad burn.

PLUSES
- PlexManager software
- Ability to copy any kind of disc

MINUSES
- CAV architecture
- Mediocre packet writing capabilities

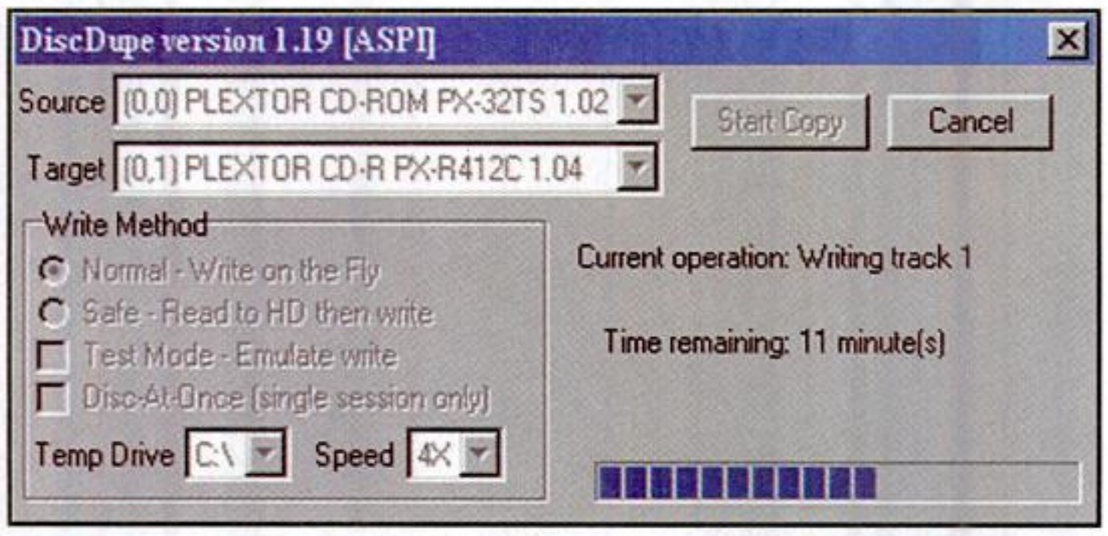
THE SPECS

INTERNAL BUFFER SIZE
2MB

INTERFACE
SCSI-2

RECORDING METHODS SUPPORTED
Disk-at-Once, Track-at-Once, Multisession, Variable & Incremental Packet Writing

SOFTWARE
- Adaptec Easy CD Creator Standard Edition v3.01a (284)
- Adaptec DirectCD v1.01b (026)


DiscDupe version 1.19 [ASPI]
Source (0,0) PLEXTOR CD-ROM PX-32TS 1.02
Target (0,1) PLEXTOR CD-R PX-R412C 1.04
Start Copy
Cancel
Write Method
Normal - Write on the Fly
Safe - Read to HD then write
Test Mode - Emulate write
Disc-At-Once (single session only)
Temp Drive C:\
Speed 4X
Current operation: Writing track 1
Time remaining: 11 minute(s)

With the UltraPlex CD-ROM, the PlexWriter CD-R, and Plextor's DiscDupe utility, no disc is immune from duplication.

MAXIMUM PC VERDICT

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Price Internal drive: $439 bare, $639 with kit; External drive: $529 bare, $719 with kit
Company Plextor
Phone 800.475.3986
URL www.plextor.com/home.htm

THE REWRITABLE FUTURE

Even though the CD-R55S and the PlexWriter are currently the best 4x12 CD-Rs on the block, they're quickly being replaced. Sony and Hewlett-Packard will soon deliver ATAPI CD-RW drives that push read speeds up to 24x, while Yamaha and Memorex are developing drives with 4x rewrite speeds and 16x read rates. These new rewritable standards approach the speedy realms of removable cartridge drives, such as Iomega's Zip, while giving you the advantage of reading CD-RW discs from any multiread CD-ROM drive. Of course, you'll be paying dearly for those newer technologies, and they don't increase the burn speeds of CD-R gold "one-off" discs.

While the CD-R55S and the PlexWriter may appear antiquated in light of these newer technologies, they're currently sitting in the pole position of the CD-R race.

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DARE TO COMPARE

MANUFACTURER	PLEXTOR	TEAC
DRIVE MODEL	**PLEXWRITER**	**CD-R555**
Record speed	4	4
Read speed	12	12
Interface	SCSI-2	SCSI-2
Drive architecture	CAV	CLV
RECORDING BENCHMARKS[1]		
Time to copy Maximum CD disc 01 (min:sec)	20:04	19:58
Time to copy a mixed-mode disc (min:sec)	19:53	20:10
Time to create 68min. Disc-at-once disc (min:sec)	18:32	25:01
Time to copy data from hard drive (min:sec)	22:29	21:55
Time to fill disc using packet writing (min:sec)	45:41	26:17
Amount of space written using packet writing (MB)	607	610
CD TACH BENCHMARKS[2]		
Drive rating	9.7	12.1
Avg. 16K sequential read (MB/sec)	1.5	1.8
Min. 16K sequential read (MB/sec)	1.2	1.8
Max. 16K sequential read (MB/sec)	1.8	1.8
Full-stroke access time (ms)	311	398
Random access time (ms)	182	181
4 CPU Utilization	2%	2%
8 CPU Utilization	3%	3%
2K Interface burst speed (MB/sec)	1.7	1.9
8K Interface burst speed (MB/sec)	3.2	4.5
16K Interface burst speed (MB/sec)	3.7	5.9
EASY CD CREATOR BENCHMARKS[3]		
Easy CD Creator Transfer Rate (Small Files) (K/sec)	361	410
Easy CD Creator Transfer Rate (Large Files) (MB/sec)	1.0	1.5
REDBOOK AUDIO EXTRACTION BENCHMARKS[4]		
CD Tach Extraction speed	12	N/A
CD Tach Auto alignment correction support	Yes	N/A
Easy CD Creator Audio Extraction speed	9	13.4
Easy CD Creator Audio Extraction Time (sec)	64	50
Extraction quality	Excellent	Excellent
REAL-WORLD COPY BENCHMARK[5]		
Time to copy contents (min:sec)	9:15	8:24

[1]Real-world recording tests with real-world data. [2]Performs a full benchmark assault on CD-ROM drives. [3]For those who demanded it, here it is. [4]Converts CD Audio to a WAV file. [5]Time to copy Maximum CD #01 to hard drive.

PLUSES
Excellent packet-writing capabilities

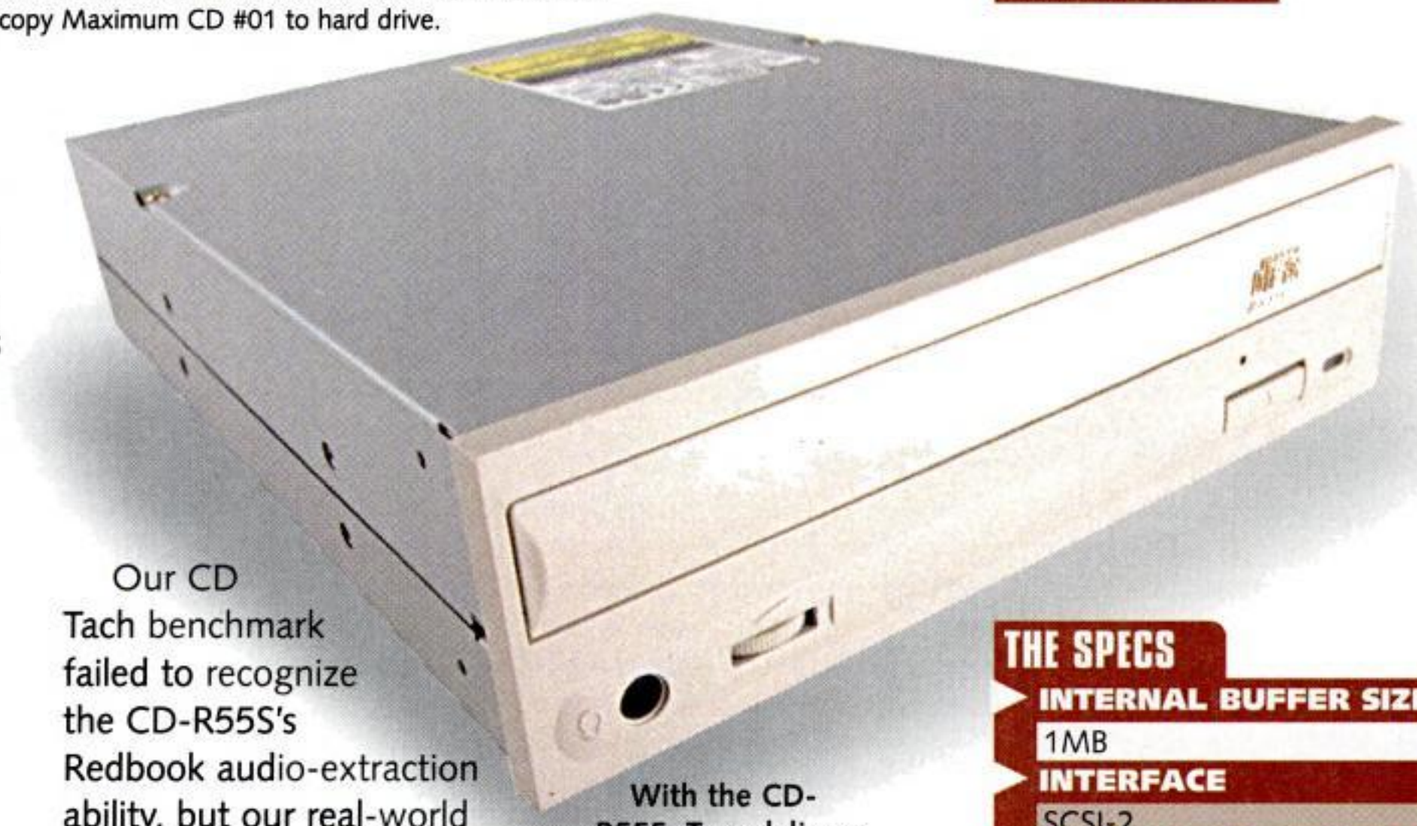
MINUSES
Digital audio extraction concerns

Teac CD-R55S

The CD-R55S goes a long way toward replacing your CD-ROM drive, with its rock solid 12x read speeds, low CPU utilization, and steady throughput. It also serves up excellent performance specs when burning CDs in all the major formats. Of course, you'll need to update the firmware and software to get the drive to work properly.

The CeQuadrat software suite that came with the drive (which includes *WinOnCD 3.5*, *just!audio* for Redbook audio extraction, and *Packet CD 2.0* for packet writing) severely hobbled the drive's performance. In fact, we couldn't get packet writing to work at all. A new BIOS revision and updated software bundle, using Adaptec's *Easy CD Creator SE* and *DirectCD v1.01b*, solved our problems and revealed a drive worth crowing about.

The CD-R55S's CLV technology delivers solid 12x read speeds across the entire disc, which kicked the PlexWriter's butt in almost every read benchmark. This Teac performed all the burn tests admirably—including the packet-writing test, which is the biggest kludge in all CD-R burners. While most CD-R drives (including the PlexWriter) take almost an hour to fill a 650MB disc using packet-writing software, and about half the time using mastering software such as *Easy CD Creator*, the CD-R55S takes the same 26 minutes to burn a packet-written disc as a mastered one.



With the CD-R555, Teac delivers a speedy contender whose packet writing skills are second to none.

Our CD Tach benchmark failed to recognize the CD-R55S's Redbook audio-extraction ability, but our real-world tests prove the drive extracted CD-ROM audio music faster than the PlexWriter and with excellent quality.

The CD-R55S is a Kick-Ass drive crippled by outdated firmware and software. If you're lucky enough to buy the drive with the updated BIOS and Adaptec software, then you've got a worthy heavyweight to any power user's arsenal.

THE SPECS

INTERNAL BUFFER SIZE	1MB
INTERFACE	SCSI-2
RECORDING METHODS SUPPORTED	Disk-at-Once, Track-at-Once, Multisession & Incremental Packet Writing
SOFTWARE	Adaptec Easy CD Creator Standard Edition v3.01b (320) Adaptec DirectCD v1.01b (026)

MAXIMUM PC VERDICT

Price $399 (internal kit), $479 (external kit)
Company Teac
Phone 213.726.0303
URL www.teac.com/teacindx.html

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This holiday season, five lucky winners will walk away with all of the gear needed to rev-up their PC for the ultimate in 3D action and sound. This year's winners will receive the following 4 products from our contest sponsors.

Sony GDM-F500 or GDM-400PS Computer Displays

Two lucky winners will receive the Multiscan F500, Sony's flagship model, introduces the very latest in advanced CRT display technology from Sony: the unique FD Trinitron CRT. Selected as the computer display of choice for Maximum PC's "Dream Machine", this virtually flat CRT minimizes geometric distortion and reduces reflective glare that may cause eyestrain. Designed with the demanding CAD and graphic professionals in mind, the Multiscan F500 redefines image performance, ease of use and reliability. This Christmas, seeing is believing, so make sure you check out Sony's GDM-F500! Three winners will take home the Sony GDM-400PS computer display incorporating the legendary Trinitron technology, now with a new flatten CRT and Sony's Enhanced Eliptical Correction System technology designed to enhance image performance.

Microsoft Digital Sound System 80

Powered by two amplifiers, the DSS80 uses a dual driver subwoofer to kick out some really deep bass and two sealed 3" satellite speakers to handle the mids and the highs. Throw in a 10-band graphic equalizer, Dolby Pro Logic, and Microsoft Surround Sound, and you've got all of the audio and digital effects you need to make the room rumble.

Aureal 3D Audio

"A3D audio by Aureal creates highly realistic and immersive 3D sound from a standard pair of stereo speakers or headphones. Originally developed for NASA, A3D uses the split-second differences between what each ear hears to re-create sounds the way they come at us in the real world: from all directions and in three dimensions. A3D works the way your ears do."

Diamond Multimedia Monster Sound MX200

Hear the full roar of jet engines, the crunch of approaching footsteps, the angry growl of alien beasts. Monster Sound immerses you in heart-pounding sound and puts you in the middle of the action. Load your weapons with Monster Sound for the ultimate 3D gaming experience... so realistic you may feel the urge to duck.

Creative Labs Graphics Blaster Riva TNT

The Graphics Blaster Riva TNT provides uncompromising 2D/3D graphics performance based on the nVIDIATM processor. It delivers incredible visual quality in colors, textures and resolutions up to 1920x1200, making it the perfect platform for power users, gamers, and graphic designers. As with all Creative products, you are ensured ease of installation, compatibility, superior quality, high performance, and award-winning customer support.

nVIDIA RIVA TNT

The RIVA TNT architecture is the first integrated, 128-bit 3D Processor that processes 2 pixels-per-clock cycle which enables single-pass multi-texturing and delivers a mind-blowing 190 million pixels per second fill rate. RIVA TNT's (twin-texel) 32-bit color pipeline, 24-bit Z, 8-bit stencil buffer and per-pixel precision delivers unsurpassed quality and performance allowing developers to write standards based applications with stunning visual effects and realism.

You can't win if you don't enter.

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Biography ▶

Nels Johnson is President of Download Recordings, a San Francisco Bay Area consulting and production firm specializing in desktop video and multimedia software development. He is the author of *How to Digitize Video* (John Wiley, 1994), *Web Developer's Guide to Multimedia and Video* (Coriolis, 1996), and *Web Developer's Guide to Multicasting* (Coriolis, 1997).

Rick Sanchez is a web and CD-ROM producer for Imagine Games Network (IGN). He has a heavy background in video production, CD-ROM development, web design, and interactive kiosk development. In addition to earning a Master's degree in film, he has taught film and multimedia production at the American University in Washington, D.C.

Lisa Rein is a freelance journalist and XML developer writing for xml.com, Wired News, *Web Review*, *Web Techniques*, *Software Development*, and NetscapeWorld. She is currently working on a book about XML to be published by Addison-Wesley, and runs her own XML resource web site at www.finetuning.com.

Phil Lacefield Jr. helped open the only Internet café in his hometown of Dayton, Ohio. He also runs a busy used computer store and a local ISP, co-hosts a call-in radio show on computers, and helps create sci-fi board games. Phil's been gaming since the VIC-20 and would really like to have a serial port permanently installed in the back of his head in order to communicate directly with his beloved Palm Pilot.

Rick Stevens is an independent multimedia developer and principle of Wordcrafted media in San Francisco, CA. His firm provides PC-based marketing, training, and communications presentations to propel business clients into the global village economy of the 21st century.

Tara Calishain has been working with computers since she was 16. Now 29, she has authored and co-authored several books on computers and the Internet, including *Official Netscape Guide to Internet Research and Official Netscape Guide to Communicator Professional Edition*. Her articles have appeared in a variety of places, including *HomePC*, *InternetWorld*, and on CINET's Gamecenter. She is the owner of CopperSky Writing and Research.

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TECHNOLOGY UPDATE

Big sound from a stereo radio—without the big price!

Zenith Audio, a leading electronics manufacturer designs a "Small Footprint", "Big Sound" stereo system and drives the price below $100.

by John Jameson

I leaned back slowly in my chair with my eyes closed, listening to the haunting melody of a Mozart symphony. The acoustics were flawless, and the room was soon filled with full, rich stereo sound. From the crisp highs of the flutes to the tooth-rattling bass of the kettle drums, the music was crystal-clear and powerful. I could distinguish the distinct sounds from each individual musician, and as the orchestra reached the finale I almost fell out of my seat from the awesome force of the music. As the music faded, I leaned forward and hit a button on the stereo clock radio. I had a concert to go to that night—it was time to check the weather.

Ultimate sound machine. Zenith Audio has developed a Digital Stereo Clock Radio that boasts the acoustic quality and practical features of stereo radios four times as expensive. You'll be amazed at the sound quality and powerful bass you get from a radio this small and this affordable. This stereo radio features an 11-key handheld remote control and an input jack for CD players or other audio sources.

The best bass. Many small stereo radios can sound tiny and weak. This unit has an exclusive EXB button for expanded bass performance. It intensifies the lower tones for CD or FM stations, giving you rich, full and powerful stereo sound. If you want to listen to the stereo in private, there is a headphone jack on the side of the unit.

Loaded with features. You won't find a tabletop stereo with more added options. The AM/FM radio features digital tuning for pinpoint reception and crystal-clear sound. The STEREO indicator allows you to tune in to the stereo signal. It also picks up TV and WEATHER signals with 13 TV channels and 7 Weather channels, so your Zenith Audio Clock Radio is a great source of news, entertainment and information. You can program the unit's memory for 37 preset stations, and the tuning buttons can operate either manually or in a automatic search mode.

Practical functions. The backlit clock has several alarm functions, so you can wake to either radio, TV, Weather or a buzzer. The sleep timer allows you to fall asleep to up to 90 minutes of music, TV or weather and then shuts off automatically. In the morning, if you need a few extra minutes of sleep, press the SNOOZE bar on the control panel or on the remote. The radio or alarm tone stops for 10 minutes and then sounds again. The process can be repeated several times as required. The unit's battery backup system will maintain the time, alarm and preset station memories in the event of a temporary power interruption. There is even a low battery indicator so you'll never oversleep in the event of a power failure.

Factory direct risk-free offer. You can spend hundreds of dollars more on a stereo radio, but why do it? We get the Stereo Clock Radio direct from Zenith Audio and pass the savings on to you. This product comes with a one-year manufacturer's limited warranty and Comtrad's exclusive risk-free home trial. If you are not satisfied for any reason, simply return it within 90 days for a full "No Questions Asked" refund.

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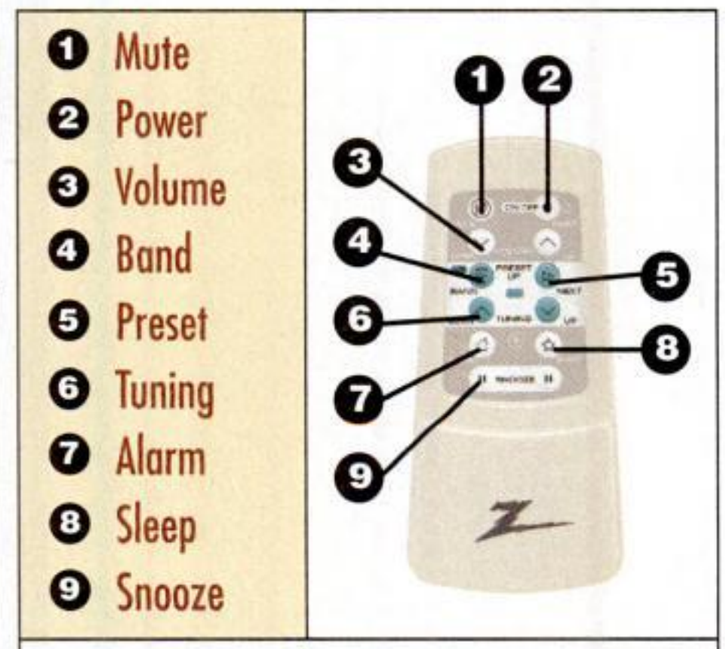

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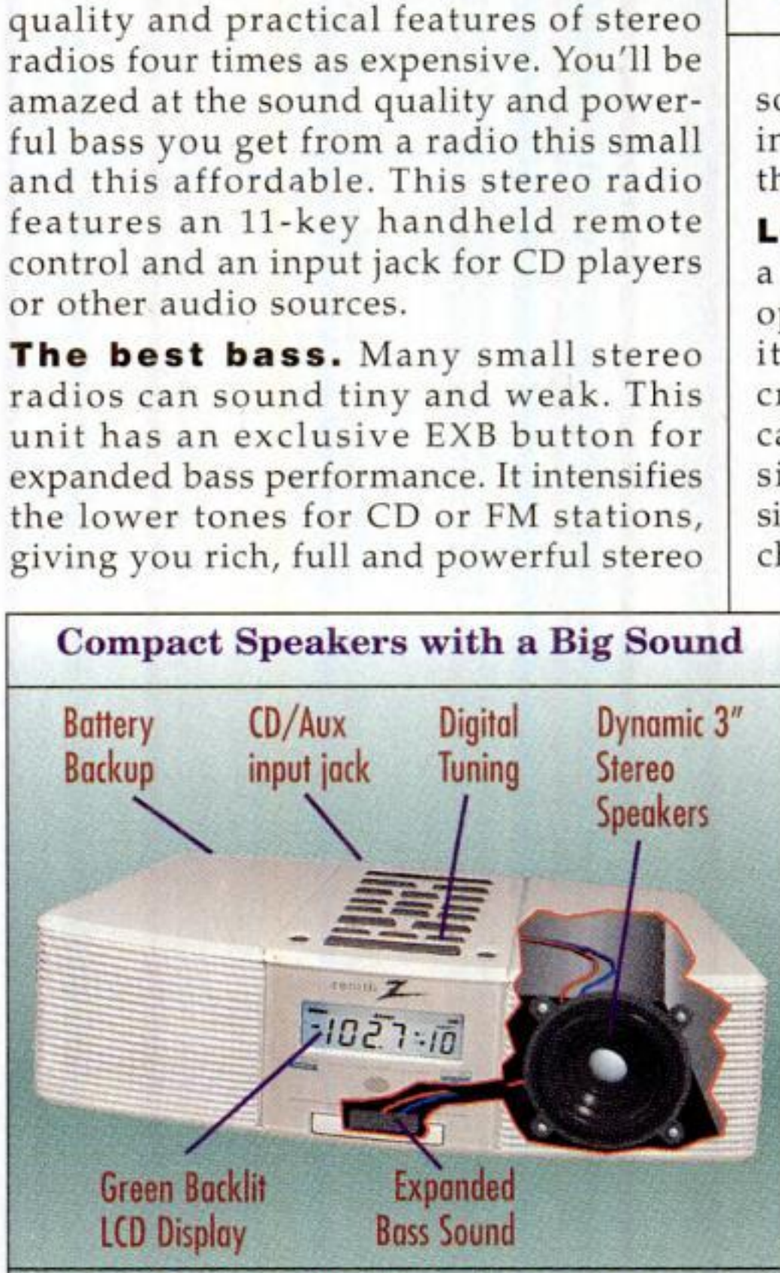

The Zenith Audio Clock Radio has an exclusive EXB button for expanded bass performance. It intensifies the lower tones for CD or FM stations, giving you rich, full and powerful stereo sound.

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-PC Gamer, January 1998

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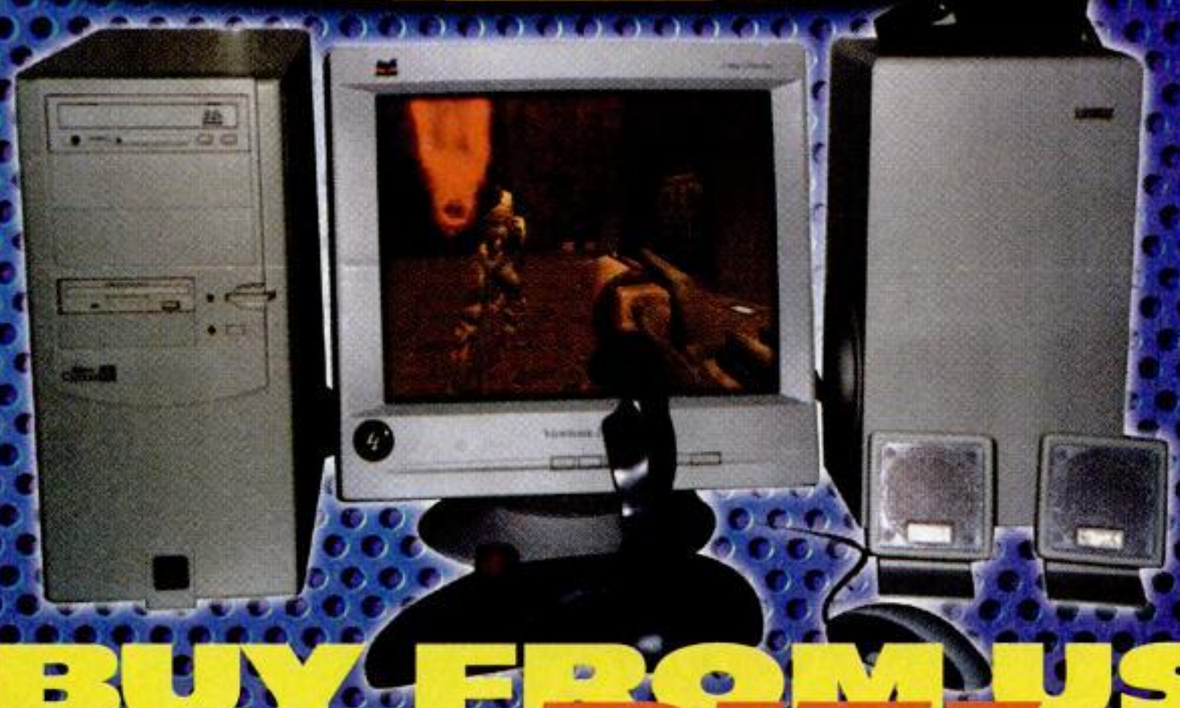

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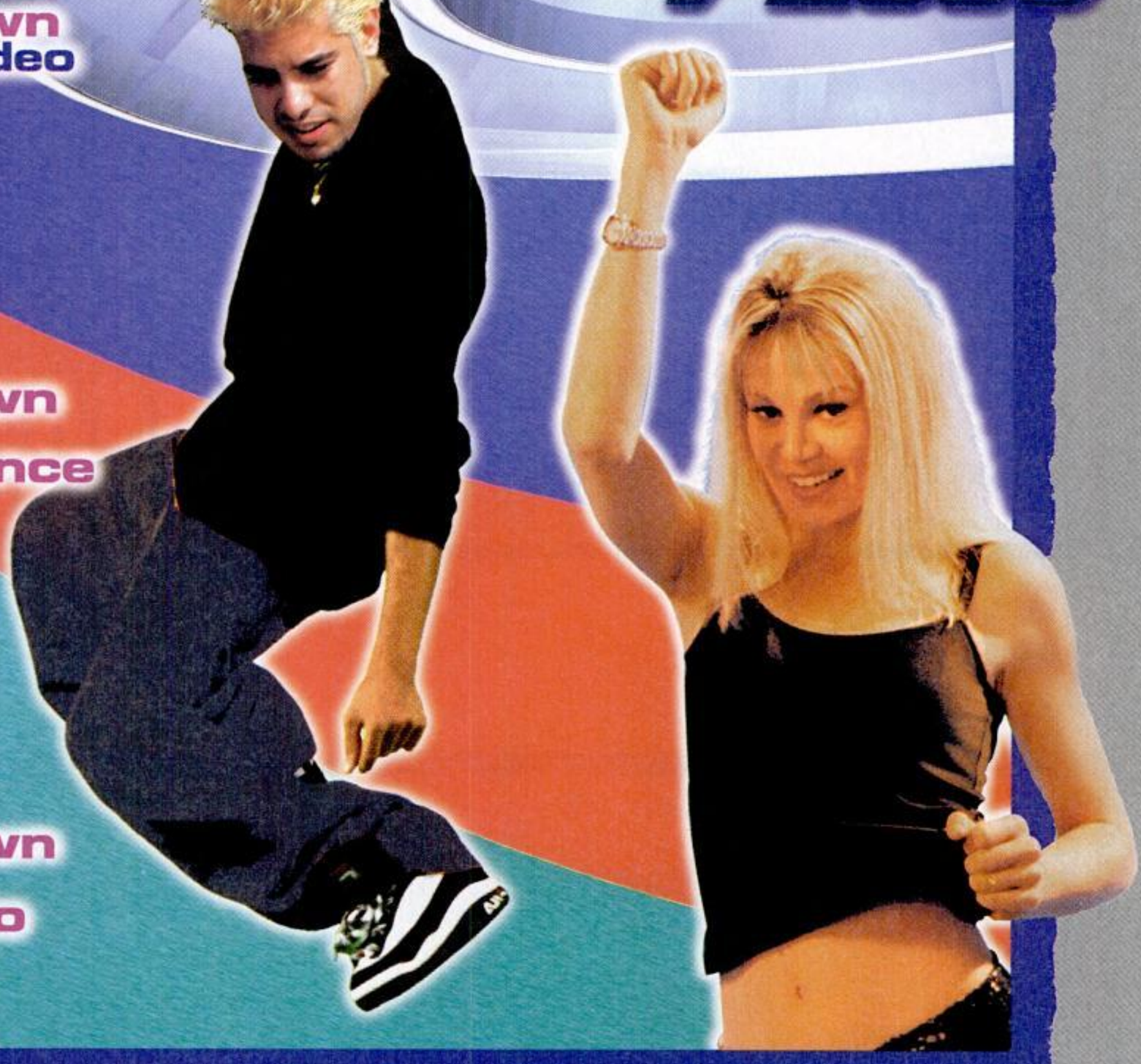

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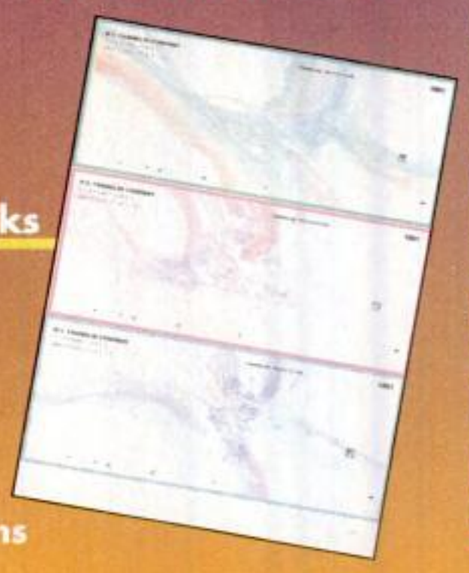

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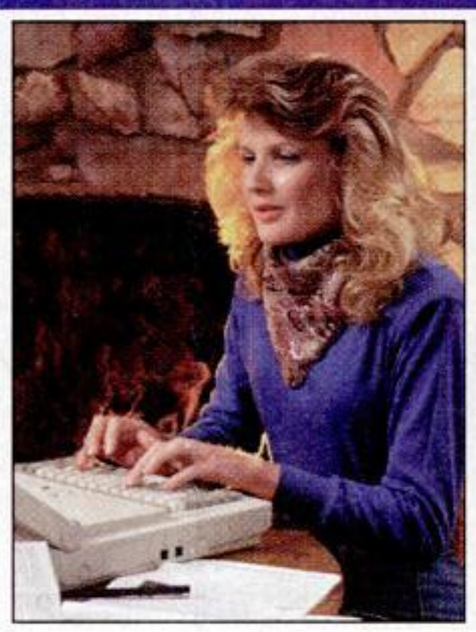

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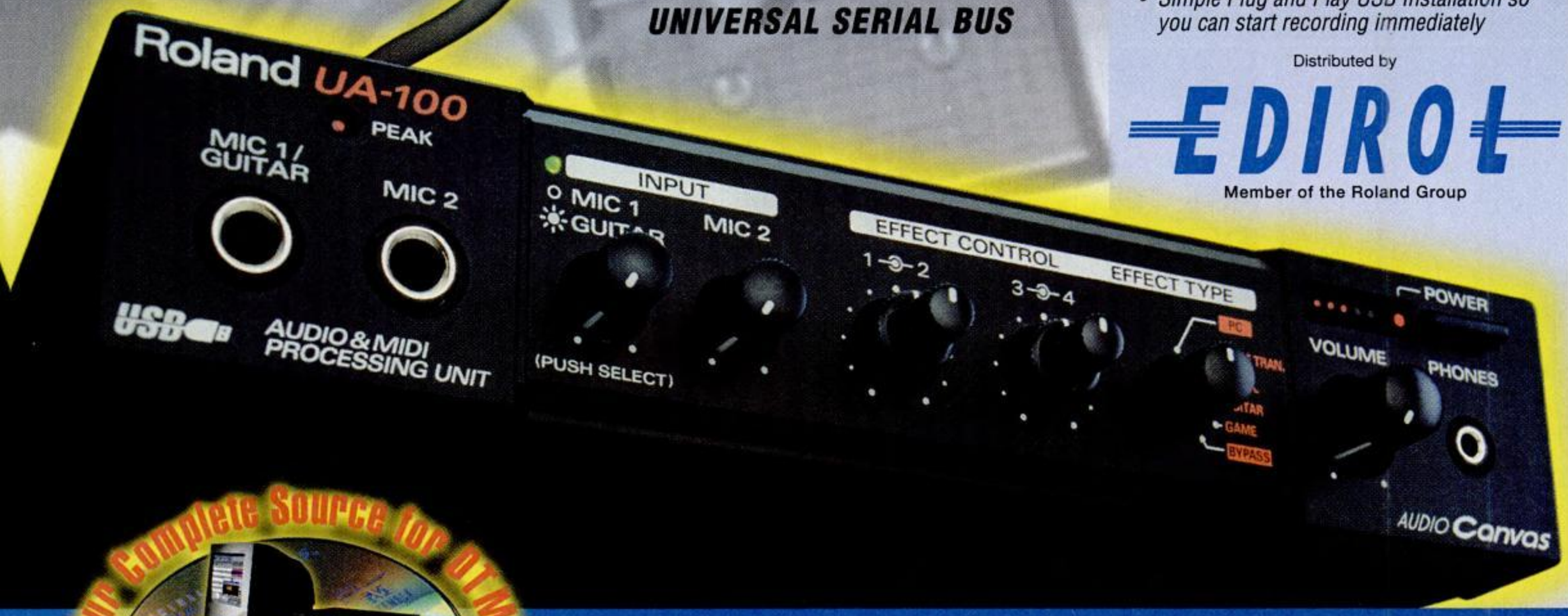

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A

ActiveX A set of Microsoft technologies that combine two other Microsoft technologies: Object Linking and Embedding (OLE) and Component Object Model (COM).

AI see Artificial Intelligence

alpha-blend The ability to give a pixel a value that will render it solid, invisible, or partially transparent. The process is often used in games to depict special effects, such as explosions and weapon discharge. When mapped onto polygons, alpha-blending can simulate semi-transparent objects, such as water and glass.

anchor points Points HTML links link to.

animated GIFs A graphics interchange format and a bit-mapped graphics file format containing multiple layers. When viewing these layers in succession, the image can appear to be moving or animated.

API extension An Application Program Interface (API) extension refers to an enhancement or add-on to an existing API. Creative Labs' EAX works with Microsoft's DirectSound and DirectSound-3D API making it an open standard.

areal density Expressed as billions of bits per square inch (Gbits/in^2) of disk surface area, areal density is the product of linear density (bits of information per inch of track) multiplied by track density (tracks per inch). It varies with disk radius. It's important because the areal density directly affects the price per megabyte of a drive.

artifact Graphical flaw caused by the shortcomings of a compression technology. Often manifest as blotchiness in what should be a solid color.

artificial intelligence The "brains" of a computer-controlled game character. AI determines how the computer reacts to human decisions.

ATA Short for AT Attachment. A hard drive with an integrated controller. There are multiple levels of ATA standards including the base-level 16-bit IDE, ATA-2 (Enhanced IDE) and Ultra ATA. Ultra ATA/66, a new spec doubling the throughput of the controller to 66MB/sec, is expected to be integrated into PCs in early 1999.

A3D see Aureal3D

Aureal3D A proprietary API for handling 3D positional sounds and doppler effects. Using algorithms developed for NASA, A3D simulates 3D positional sounds on two speakers. A3D will support four or more speakers, but is optimized for two.

authorability The ability to design, develop, or produce software.

auto texture compression A videocard's ability to automatically compress texture data on-the-fly, without user intervention. This shrinks the data size down, thus allowing more and higher-resolution textures to pass through the data path at a given time.

A/X A video editing term. "A" usually represents your primary source deck, and "X" represents a live source.

B

baseline A method of comparison.

bezier A curved line defined by at least three adjustable points. The shape of the curve can be altered by tweaking the handles extending from each point.

bezier control point deformation Defining the contours of an object or path using discrete points on it by moving "control handles" that alter the curvature of the spline entering and leaving these points.

bilinear filtering Bilinear interpolation. An algorithm that can be used to apply textures to 3D objects. An example would be to apply a texture of bricks over a sphere, making it look as if it were composed of bricks.

BIOS Basic Input/Output System. Software that contains your computer's most rudimentary instructions on how the operating system communicates with hardware. Your BIOS runs at startup, configures devices, and then boots the OS. Because the BIOS is so integral to getting your computer started, it's stored on a separate ROM chip, not your hard drive, to isolate it from crashes.

blit Bit Level Transfer. The act of drawing a pixel on screen in a 2D application. Examples of this include drawing sprites in a game or manipulating graphics in a Photoshop file.

blocky filtering A term to describe texture-mapping visual quality that resembles blocky point sampling as opposed to smooth bilinear filtering.

boning The placement of control vertices called "bones" within a mesh object. A related set of bones forms a hierarchy that, when associated with the mesh, defines mesh movement in animation.

boot Also known as the "boot process." To turn on a computer. To gather hardware information and load software, such as the operating system. Slang: to throw up, hurl, vomit, or toss your cookies.

broadcast conformity Ensuring your video meets broadcast specifications, meaning your whites aren't above +110 ire and your blacks aren't below -40.

bump-mapping A visual trick that attempts to simulate a texture's roughness or smoothness, depending on how the texture reflects lights. In 3D, this is usually accomplished by laying two textures onto a polygon—a base texture for the graphics, and a second displacement texture that is mapped on the object. This second texture determines how "rough" the surface will appear.

C

Cascading Style Sheets Templates in which you define the style for a particular HTML element once, link font style or color, and then use it over and over on any number of web pages.

Category-5 A network-cabling standard that supports 100Mbps data throughput.

CAV see Constant Angular Velocity

CCD Charge-Coupled Device. Sensor used in digital cameras distinguished by semiconductors connected so that the output of one serves as the input of the next.

CD-RW See Compact Disc-Rewritable

Character Generator (CG) A software application for creating titles and credits.

chroma key Hardware effect that lets you sample out a colored background, remove it from the picture, and replace it with something else.

CMOS Complementary Metal Oxide Semiconductor. Sensor used in digital cameras whose semiconductors use both negative and positive polarity circuits and require less power than CCDs.

collision detection The ability of a 3D object to physically react to another 3D object in space and time.

color cast Tint present across an entire image that does not reflect the actual light being photographed.

color shift See color cast.

colored lighting The first 3D games used simple white light to illuminate objects and cast shadows. With the advent of faster CPUs and 3D hardware acceleration, games now have the raw power to mix different colored lights to achieve more spectacular ambient effects.

Compact Disc-Rewritable A rewritable technology whose media can be written to and erased approximately 1,000 times before failure. Standard 74min CD-RW media can hold up to 500MB when formatted for fixed-length packet writing.

CompactFlash Portable memory format that is read, via adapter, in PC card drives.

composite TV A video signal where the red, blue, and green signals are mixed together. Usually, the output connector will be an RCA cable type.

compression algorithm Formula that calculates how aggressively an image processor replaces image data with smaller pattern information. The end result is smaller files and more artifacting, in direct proportion.

compressors A routine or program that compresses data.

Constant Angular Velocity CAV CD-ROM drives spin the disc at a constant speed, so the data rate increases as the pickup moves to the outer edges of the disc. Constant motor speed eliminates the need for settling of the optical pickup after seeking data, resulting in an improved access rate. CAV-based drives are simpler to design and produce because the motor doesn't need to change speed.

continuous zoom Any lens that magnifies the image without incremental steps

control A program module that enhances the functionality of a program. A control is often a user-interface function. In the Windows environment, OLE controls and ActiveX controls are examples.

cropping Deleting peripheral data around a selected portion of an image.

D

daisy-chained Devices connected in a series, with each device serving as a data conduit for the next device in the chain. This precludes the need to connect each individual device to a central computer or hub.

data degradation What happens when the video signal loses digital picture information.

data visualization The translation of numeric data into a visual picture that helps the human eye pick out patterns in the numbers that are not as easy to pick out when looking at the raw data. Graphing spreadsheet data in Excel is a simple form of data visualization.

deathmatch A term used to describe any multiplayer gaming scenario where the object of the game is to kill as many of your opponents as possible. Made popular in id's first-person shooters Doom and Quake.

decompressors A routine or program that restores compressed data back to its original size.

deformation lattice modeling Altering the shape of a 3D object using an imaginary lattice of points surrounding the object to be modeled. By moving the lattice, a force is exerted on the object itself causing it to deform.

digital zoom Method of magnifying a digital image that does not employ optical magnification via lens differential. Instead, image data is interpolated up from existing data.

DirectSound A Microsoft API that is part of the DirectX package. Games send their audio output to the DirectSound "port," where a Windows 95–compatible soundcard is listening and plays the appropriate sound. This helps with compatibility because developers no longer need to be concerned with what soundcard an end user has, as was typical in the DOS days.

DirectSound3D Microsoft's API for handling 3D positional sound. Plagued by problems when originally introduced, it has improved greatly and is beginning to generate more developer support.

Direct3D A subset of Microsoft's DirectX Application Program Interface. This interface allows developers to use hardware acceleration for 3D graphics, which helps games run faster by offloading the 3D processing onto a dedicated piece of hardware.

DirectX A collection of Application Programming Interfaces (APIs) developed by Microsoft. This driver model helps create a unified multimedia platform on PCs. Parts include Direct3D, DirectSound, DirectInput, DirectDraw, and DirectPlay. Multimedia developers can theoretically write to the standard DirectX API and know hardware that supports it will work instead of writing to individual hardware APIs. It also allows graphics applications to take advantage of hardware acceleration supported by graphics accelerators.

dithered textures When an image's color depth is lowered from a higher count to a lower count, it is said to be dithered down. When this happens, any lost color data may be seen by the naked eye as dotted patterns or extraneous artifacts.

D1 Otherwise known as Serial Digital. It is an uncompressed video form.

doppler shift In the sound realm, a doppler shift is the apparent frequency shift you hear as an object approaches and passes, such as a train passing by and diminishing as it moves past you.

DOS partition A special section of the hard drive that uses the traditional Disk Operating System instead of a Windows-based operating system. Disk drives can have multiple partitions, each of which are assigned a separate drive letter (C:\, D:\, E:\).

downsample Process of taking a file with more resolution and eliminating unnecessary data to achieve a smaller file.

driver The closest layer of software between an operating system and a piece of hardware.

dual-32-bit Refers to the number of processors, and the data bit width, of a graphics processor.

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DVD +RW A DVD rewritable format based on CD patents from Sony and Philips that uses CD-RW phase-change technology. It is formerly known as +RW and is not a DVD Forum–approved specification. It has a capacity of 3GB for a single-sided discs and 6GB for a dual-sided discs. It should be available in early 1999.

Dynamic HTML A marketing term used to describe a collection of browser-specific behaviors based on combinations of the following standardized technologies: Document Object Model (DOM), HTML, Cascading Style Sheets (CSS), and EcmaScript (standardized JavaScript).

E

E. coli The abbreviated name of the bacterium in the family Enterobacteriaceae named Escherichia (genus) coli (species). It is also a dangerous bacteria found naturally to occur only in cattle. This bacteria is most frequently acquired through consumption of undercooked ground beef and unpasteurized milk.

editor A tool or set of tools for modifying the elements of a game world or file.

Ethernet A networking protocol that supports 1,024 nodes at 10Mbps throughput via twisted-pair, coaxial, and optical fiber cabling. The Fast Ethernet protocol increases throughput speed to 100Mbps.

external flash sync port Jack for attaching a flash unit to a camera that synchronizes the camera's shutter to the burst of light.

extruding Drawing out the contour of a two-dimensional path or shape into 3D space by extending it in a plane perpendicular to that of the 2D path.

F

filtering The ability to take a pixel point in an image, perform a comparison between neighboring pixel values, applying a filter that'll interpolate between the two pixel RGB values, then apply that pixel to that point. It's a means to smoothing out blocky textures. See also bilinear filtering and trilinear filtering.

firmware Instruction code embedded in digital hardware that enables basic operations.

fixed zoom Opposite of "continuous zoom."

flagella Whiplike parts of a cell that are organs of locomotion or that produce a current in the surrounding fluid.

flash slave Photovoltaic module that detects burst of light from on-camera flash and creates a signal to fire external flash unit(s) in sync with a camera's shutter.

floating-point A computer operation that uses a "floating" decimal point to quickly calculate a large set of numbers in one fell swoop. 3D games, Photoshop filters, and scientific simulation programs all use floating-point operations. For example, a 3D game uses floating-point operations to rapidly calculate the numerous changing polygons in its complex 3D environment.

Foundation The original family of DirectX APIs that form the lowest level of multimedia services. These services typically mirror the functionality available in hardware.

G

gamma correction The ability to manipulate the red, green, and blue (RGB) values of an image. This can affect how light or dark an image is.

GDI End-User Interface The Graphics Developer Interface is Windows' original graphics API, which lets Windows application developers draw on-screen. Prior to DirectX, it was the only Windows API for generating graphics and is the interface used in nearly all nongame Windows applications.

gobos Patterned mesh or gel placed between a light source and the scene it illuminates. The resulting patterned lighting effect adds interest and drama to the scene.

golds A slang term for the discs created by CD-Recordable drives. The term gold refers to the 50nm- to 100nm-thick 24K gold layer that sits atop a thin layer of organic dye on which pits are etched during the recording process.

H

hi-pass crossover A series of capacitors, coils, and resistors placed within an audio signal path that filters out low frequencies and lets only the high frequencies pass through. Hence the name, "hi-pass" filter.

HRTF Head Related Transfer Function. The algorithms folks such as Aureal use to create "3D" sound from two speakers in front to sound like sound that is around you.

HTML HyperText Mark-up Language. Code that makes web pages.

HTML scripts Scripts placed within the HTML script element tags.

hypertext Text or images in a document that link to related text.

I

image-to-image transfers The DirectX transforms between images. This is similar to a Photoshop filter such as blur, wipe, and fade.

interactive virtual sets A realistic-looking set that's been created using 3D software. When the talent are standing in front of a blue screen, they can be chroma keyed out and their backgrounds and foregrounds can be replaced with an interactive virtual set.

interchangeable lens The ability to remove one lens from a camera and replace with a more appropriate model, usually either wide-angle, telephoto, or macro.

intranet An internal corporate network. An intranet web site looks and acts just like any other web site, but includes a secure firewall to protect it from unauthorized entry from nonemployees.

inverse kinematics A system of defining interrelationships between objects linked in a hierarchy. Each object is moved according to these relationships relative to the others. The "inverse" designation signifies that the last object in the chain is moved and the relative movement is computed from it up through the last or root object (highest in the hierarchy) rather than from the highest to the lowest in the chain (forward kinematics).

IPX/SPX Internet Packet Exchange/Sequenced Packet Exchange. Closely linked protocols that help data get from Point A to Point B across a network. IPX routes data packets to the appropriate network node. Because data packets can sometimes get lost while traversing a network, SPX ensures that all the packets belonging to a single file get to the node intact.

IrDA Infrared data-transfer protocol that allows wireless connections between conforming hardware.

ISDN Integrated Services Digital Network. An international digital telecommunications standard that accommodates voice, data, and signaling over digital telephone lines. Its two common twisted pairs of wires deliver two 64Kbps bearer signals and one 16Kbps data signal. The two bearer signals can be used simultaneously, one for voice and one for data, or you can use both lines for data for data rates of 128Kbps.

I/O connector Any connector that allows a user to add-on a device for the computer's use. A serial or parallel port is one example of an I/O port. An AGP or PCI expansion slot is another example of an I/O connector, where devices can be connected to a PC.

ISP Internet Service Provider. ISPs are companies that sell Internet access to businesses and individuals. Local phone companies and long-distance companies can be ISPs, but most ISPs are independent vendors.

J

JavaScript Scripting language to extend the capabilities of HTML that both Navigator and Internet Explorer can read.

K

keyframing In animation, an image used at the beginning and/or end of an animation sequence as a reference point.

L

language Syntax used to describe functions to computers. Java is a language, HTML is a language, Cobol is a language, etc.

lazy susan A circular tray that spins. It is generally used for dining purposes.

lithium-ion Variety of rechargeable battery known for longer charge life and less memory effect.

live eight-channel switcher A hardware board that coordinates the video signals that are coming in from eight different sources.

Local Area Network Any computer network that is confined within a specific geographical area.

logical volume Logical refers to a user's view of the way data is organized, volume refers to a specific amount of storage. A logical volume, then, is an amount of disk storage that is organized in a way users can understand.

M

Macintosh A family of personal computers from Apple, introduced in 1984. It was the first computer to popularize the graphical user interface (GUI).

mainframes Large computers used by big businesses. Before the invention of minicomputers and personal computers, all computers were mainframes. A typical modern mainframe is the IBM S/390.

Media In DirectX, the layer of multimedia APIs built on top of DirectX Foundation to make it easier for multimedia developers to program certain multimedia functionality (such as video playback and Internet streaming support) without worrying about the intricacies of the hardware.

megapixel Category of digital camera whose total pixel count exceeds 100,000. This is determined by multiplying the camera's horizontal resolution by its vertical resolution (i.e., 1280x960=128,800).

metaballs Modeling and animation technique using spherical or elliptical 3D objects in groups with gravitational attraction for one another. The closer they move together, the more they meld into an amorphous mass, with each object retaining its independence of movement. Perfect for modeling organic shapes.

microcode Low-level instructions or commands that can be executed to perform a particular function.

MIDI Musical Instrument Digital Interface. MIDI files (typically found in games or posted on web sites) trigger a set of recorded samples in your computer's soundcard and define how the samples will be played back according to pitch, tempo, and rhythm. The result is lo-fi, robotic-sounding music. But because MIDI files are mere triggering mechanisms, and not large, bandwidth-intensive CD-quality audio files, they can be implemented in games without suffering a performance hit. The sound of MIDI-based music is ultimately dependent on the quality of a soundcard's sample library. There are 16 MIDI "channels" for each of 16 "ports." Each channel is assigned to a particular instrument or effect, which is in turn assigned a port. Anything on the same port and channel will respond to the MIDI events that correspond.

miniGL driver A software driver that interfaces between the videocard and an application that uses only part of the OpenGL instruction calls (hence the term "mini"). The videocard is then able to perform OpenGL commands via this driver.

Minox An über-tiny film camera popular with operations such as Hogan's Heroes and the Mission: Impossible crew.

mip-mapping Technique used to generate scaled texture maps that involves creating sub-images sized for every inverse power of two: i.e. 1/4, 1/16, 1/32, etc. The process of creating a mip-map takes time, and larger textures will require more.

model A previous example or methodology to compare to or analyze your current plan or idea.

modelling light Lights built into studio flash units that stay on continuously (as opposed to the burst of the flash head) and allow photographers to aim and shape the light the head will produce.

Motion Graphics Module A hardware board that accelerates 2D and 3D transitions

multipass texturing The process of applying multiple textures to polygons in a model by performing multiple texturing passes (called blending) until the image is completed.

N

nanotechnology A field of science whose goal is to control individual atoms and molecules to create computer chips and other devices that are thousands of times smaller than current technologies permit.

near-field response An audio term that refers to the sonic characteristics of a speaker system. Near-field response speakers sound best when you are positioned really close (or near) to them. A far-field response speaker, well, you get the hint.

Neodymium A rare earth magnet. Stronger than conventional magnets, Neodymium is used in situations when you want a smaller magnet, but do not wish to give up magnetic strength. Often used in automobile speakers, Neodymium has made its way into the computer desktop speaker arena.

nested tables Used to describe the occurrence of tables placed within other tables, usually for presentation effects

NetBEUI NetBIOS Extended User Interface. A networking protocol used by Windows For Workgroups and Windows NT.

network requestor A networking protocol that determines whether application requests are to be handled locally or on a remote computer.

Ni-MH Nickel Metal Hybrid. Variety of rechargeable battery.

NLX formfactor A new low-profile modular motherboard formfactor for thin desktop PCs and arcade machines. NLX's profile design requires expansion cards, such as videocards, and so forth, to be lower in height than an AT/ATX-bound expansion card.

NOD Proprietary native file format used in NetObjects Fusion.

nonlinear Nonlinear editing refers to editing that's done via hard disk.

NURBS Non-Uniform Rational B-Spline. A mathematical representation of a three-dimensional object.

O

objects Modules of information.

occlusion A blockage or occlusion in audio is the difference between hearing a sound without barriers and then behind, say, a door or wall.

OEM An original equipment manufacturer. OEMs purchase hardware and software in bulk, and resell systems to consumers with an added mark-up.

OGL multitexturing short for OpenGL multitexturing.

optical zoom Method of magnifying a digital image that employs optical magnification via lens differential.

organic wipes A transition between two video shots that have a natural feel to them.

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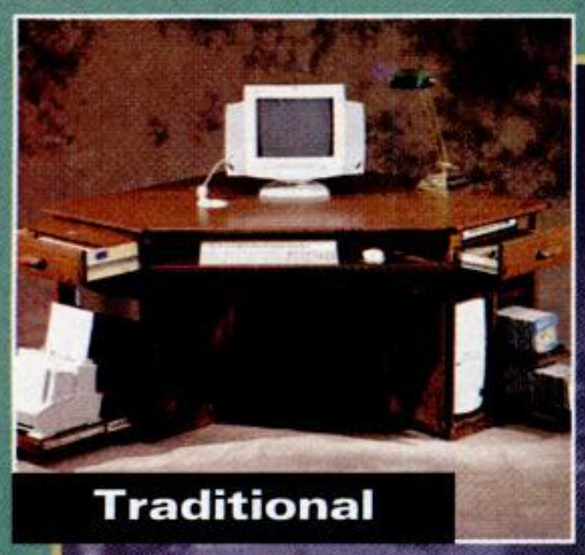

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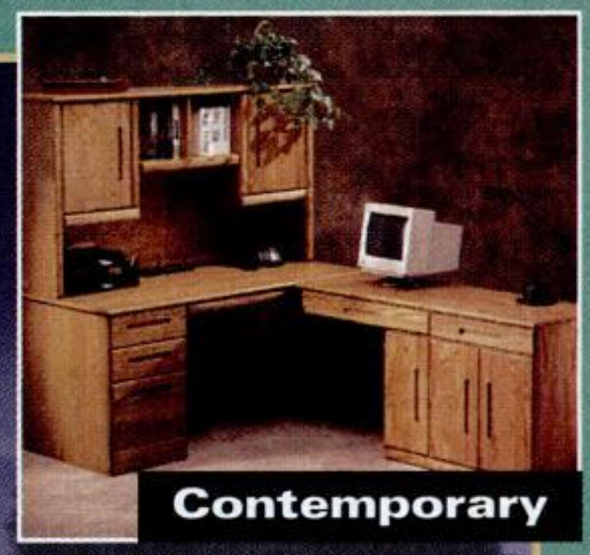

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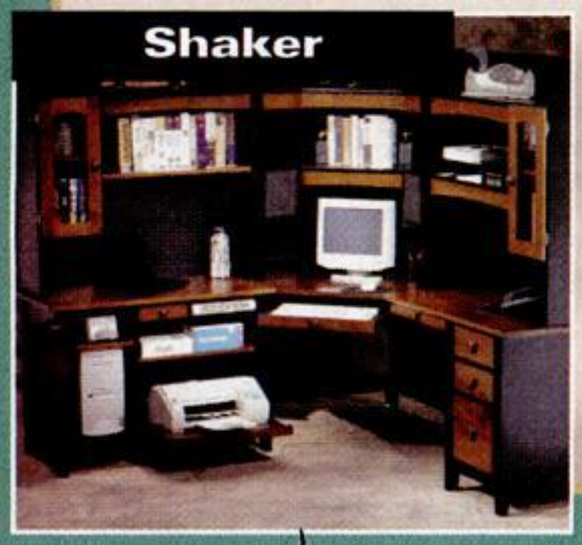

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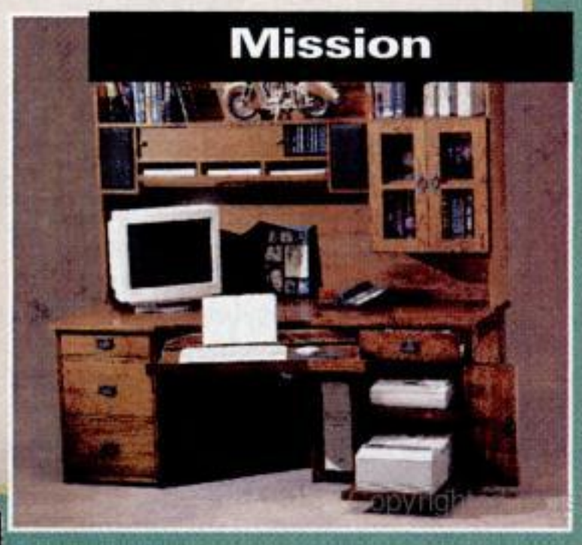

Mission

overclock To purposefully alter the clock timing of a microprocessor beyond its factory specs in a desperate attempt to squeeze out more performance. Often results in unreliable operation.

P

PCI Peripheral Component Interface. 32/64-bit expansion slot/bus interface (running at 33MHz, or half the system-bus speed, and occasionally at 66MHz) developed to help break the slow 8/16-bit Industry Standard Architecture (ISA) bus bottleneck, which ran at 8MHz. This faster bus allows faster data transfers, thus speeding up any input/ output. Videocards, I/O cards, SCSI cards, and other high-speed devices benefit greatly from the PCI interface's faster speeds.

PCMCIA card Personal Computer Memory Card International Association. Portable device standard most commonly used in notebook PCs. Now more commonly known as PC card.

pipeline Also referred to as a communication channel or bandwidth (the amount of data that can be transmitted in a fixed amount of time). The fatter the pipeline, the faster the data will flow.

pipeline-processing when a microprocessor begins executing a second instruction before the first has been completed. Several instructions are in the pipeline simultaneously, each at a different processing stage.

plug-ins A software module that adds a specific feature or service to a software application. For example, web browers include plug-ins to view video or hear audio.

polygon primitives A term used to describe the most basic of polygon shapes, such as a square or triangle. By molding several of these primitives together, you can build an approximated shape of an object you wish to create. Think of them as building blocks for a much larger polygon object.

proprietary Hardware or software that is owned or controlled by an individual, group, or company.

proprietary dithering algorithm The instruction set that a videocard uses to render pixels to the screen.

pundits Experts on one or more subjects who frequently offer their opinions in the media and at conferences.

R

radiosity A rendering technique that computes the diffuse inter-reflection of light between all surfaces in an image. This technique provides soft, subtle ambient shading and reflection between objects and low reflectivity. It excels at interior architectural rendering.

RAMDAC Random Access Memory Digital to Analog Converter. The chip on a videocard that converts the bits of a digital image into an analog signal. It maintains the color palette and determines refresh rates. The faster the RAMDAC MHz, the higher the refresh rate your system can handle.

rangefinder Device for framing a photograph that views the scene to be captured directly, as opposed to via an LCD monitor or through the actual lens used to capture the image to film (see SLR).

raytrace A method of 3D rendering in which light beams are followed individually from their source to the illuminated object and back to the camera. The resulting shading and illumination give a highly realistic appearance and are necessary for rendering true refraction, reflection, and transparency.

reflections A mirror-like image. In reference to Aureal's A3D 2.0, sounds will sound more real because they are actually reflected off surfaces like in real analog life.

refresh rates The rate at which a monitor redraws the image on its screen; measured in hertz (Hz). Refresh rates below 75Hz (75 redraws per second) typically create a flickering effect, which causes eyestrain.

resolution Horizontal and vertical image detail as measured in individual picture elements.

retain-mode meshes A mesh is a collection of triangles that can be treated as a single object. Retain mode is the DirectX Media API that Chromeffects uses to carry out 3D rendering. Retain mode uses viewpoints, lights, and 3D polygon meshes to render a 3D scene.

reverberation An echo-like sound or effect.

RS-422 A VTR protocol language that lets your computer talk to multiple video devices from a central computer interface.

S

SDI modules Serial Digital Interface. An SDI module is an uncompressed video in/output port for broadcast digital video.

SDK Software Development Kit. An SDK contains source code and other information that allows programmers and developers to support hardware or software applications.

SDRAM Synchronous Dynamic Random Access Memory. It is a faster type of memory that synchronizes with the CPU. Its architecture allows it to run fast enough to handle the 100MHz system bus.

sepia tone Process that renders an image in tones of brown; popular in antique photo booths found at state fairs.

serial cable Cable that transfers image data from the digital camera to the PC via the syrupy-slow serial bus.

SGML Standard Generalized Markup Language. An international standard for electronic document exchange and the basis for HTML.

shutter speed Duration of time that a camera's shutter—the door that blocks the light-sensitive recording surface—is pulled back to expose the image. Relatively fast shutter speeds are required to capture motion; slow shutter speeds allow more light to pass for low-light shooting but also risk blurring the image from motion, either by the subject or camera.

SLR Single Lens Reflex. Most common variety of traditional film camera, where the image to be photographed is viewed through the actual lens that captures the image to film.

spec Short for specification. A detailed statement of technical particulars.

specular shading In 3D rendering, it's a polygon's ability to correctly present lighting as it reflects off its surface. Specular shading, or highlighting, refers to the fact the material's lighting attributes take into account both the location of the light source and the observer. Specular highlights account for how shiny a material seems—the greater the specular highlights, the shinier the material.

spline Vector defining a shape or path controlled by "control vertices." These vertices define the shape and curvature of the spline.

S-Video Super-Video. A video standard that divides the signal to carry brightness and color information separately. Also referred to as Y/C, it is a connector that carries the video signal in its separate luminance and chrominance components. If you have this and composite jacks on your camera or deck, use the S-Video for better picture quality. S-Video uses a five-pin connector, not RCA jacks.

swap files When an application runs out of system memory, it begins using the hard dive as virtual memory to save application and document data. The hidden temporary files written to the hard drive are called swap files. Unfortunately, writing to even a SCSI hard drive is an extremely slow process compared to writing to system memory, so you always want enough system memory to meet your application and document needs.

sync-roll A type of editing that uses hardware synchronization and time-based correction to control your video sources.

T

TBS Time base corrector. Adjusts a video's color to meet broadcast specs.

TCP/IP Transmission Control Protocol/ Internet Protocol. A blanket term for a suite of Internet communication protocols. In its most base definition, IP routes data packets across the Internet, while TCP makes sure all the packets arrive correctly on the receiving end.

10/100BaseT An Ethernet standard that supports both 10Mbps and 100Mbps data throughput via the same hardware device.

texel Short for TEXture ELement. Refers to the individual pixel that makes up a bitmapped graphic that is used as a texture when it's applied on a polygon.

texture A graphical element, usually a bitmap, mapped onto a polygon in 3D space.

texture seams Unsightly artifacts and stray pixels in between two textures that are mapped next to each other. Usually seams are either white or white pixels, or you'll see background artwork peering through. Caused by bad programming or bad video chip drivers.

TFT Thin Film Transistor. The essential component in any modern LCD notebook or flat-panel display.

thin coax A type of network cabling that consists of a single wire surrounded by a metallic shield that cuts down on interference.

3D picking Picking out objects in a 3D space. Unlike 2D, which may be confined to simple rectangles on the screen, 3D buttons come in a variety of shapes, may mutually occlude each other, be animated, or warped around a complex 3D surface. 3D picking is the process of selecting a button or object in a 3D scene with the mouse or keyboard.

three-band parametric equalizer A device used to equalize your digital video's audio.

3D engine A group of software routines that render polygonal models overlaid with texture maps in order to create the illusion of a world in three dimensions.

threaded mount Lens accessory that allows photographic filters to be screwed onto the front of the lens.

three-finger salute General computer slang for giving Windows 95 the bird or rebooting by pressing Ctrl-Alt-Delete.

Toaster/Flier A nonlinear video-editing box developed by NewTek.

T1 A high-speed, dedicated phone line for digital communications. T1 lines are usually leased by businesses to link web servers or corporate networks to the Internet. Their speed is 1.5 megabits per second.

transforms A DirectX transform is a plug-in for Chromeffects that allows independent developers to create their own custom special effects for Chromeffects web pages.

transparency A term to describe a material's attributes as see-through, not opaque, so you can see objects behind the material.

tree structure A type of data structure in which each element is attached to one or more elements directly beneath it. The connections between elements are called branches.

trilinear filtering Similar to bilinear filtering, but images are interpolated in three dimensions. It relies on the use of a set of texture maps called mip-maps that each represent a different level of detail (LOD), resulting in images that are dynamic and that flow smoothly without flickering, even on images with great depth of field.

trilinear mip-mapping See trilinear filtering.

twisted pair A type of wiring used in network cabling. Twin thin-gauge wires are twisted around each other to reduce interference from other twisted pairs in the same cable—one wire carries data while the other absorbs interference.

U

Ultra DMA Ultra Direct Memory Access. The fastest IDE protocol for connecting hard drives and removable storage devices. Capable of 33Mbps throughput.

Ultra Wide SCSI One of the faster SCSI protocols. Supports 40Mbps transfer rates.

upsample The opposite of downsampling. A situation where data, usually graphics or sound, are given more data than originally planned and then presented to the end user. For graphics, this usually means putting more colors into a picture or bumping up the color depth from 64K colors to 16 million colors.

USB Universal Serial Bus. A new, faster, digital I/O port proposed by Intel for motherboards. Taking up far fewer resources, this port can act as a serial, parallel, mouse, keyboard, joystick, and even speaker interface. Unlike other communication ports on a PC, USB can be daisy-chained up to 127 devices. With the release of Windows 98, expect USB products to start filtering into the market place.

user interface A set of commands or menus through which a user communicates with a program or software application. Menu items could include such things as file access, editing/viewing functions, and user preferences.

UV mapping The act of defining placement of a bitmap or pattern on a 3D object when rendered. "U" represents the horizontal coordinate, "V" the vertical.

V

vertex movement The act of changing a polygon's orientation by moving a vertex or end point which defines its corner point in 3D space.

volumetric lighting Lighting effect defined by a particle system. The patterns formed by the particles give the impression of light shining through a dense medium such as fog or smoke.

W

waveform monitor A device that's used to analyze a broadcast video signal.

WRAM Windows RAM. A special type of video memory developed by Samsung. Similar to VRAM's dual-porting, WRAM is generally regarded as faster because of the larger blocks or "windows" that it can use.

wrapper A program written to act as an interpreter, or liaison, between two APIs. For example, a videocard vendor can write a wrapper that takes OpenGL instructions and converts them to its own proprietary API instructions, such as 3Dfx's Glide, Rendition's Redline, or S3's Metal.

write times Time lag required for a digital camera to copy image data from the volatile image buffer to the nonvolatile main memory, where it is stored until needed.

Z

Z-buffer In a 3D videocard, local video memory is often used to form a frame-buffer, which stores all sorts of data required by a 3D card in order to properly render a scene onto your monitor. With the advent of texture-mapped polygons interacting in a 3D world in realtime, the need to have a buffer with which to track positioning became a necessity. A Z-buffer stores the Z-axis value (front to back) of a pixel on-screen—this value is compared with incoming Z-value data to determine whether the pixel will be drawn or not, and how overlapping pixels will be presented. How accurate a Z-buffer is dependent on how the 3D accelerator handles Z-buffer calculations, and how much memory is allocated to it. Higher color-depth rendering requires more Z-buffer memory, as the amount of pixel information is made larger with more color usage. It speeds up 3D gaming by not rendering the parts of a scene that are obscured by other objects.

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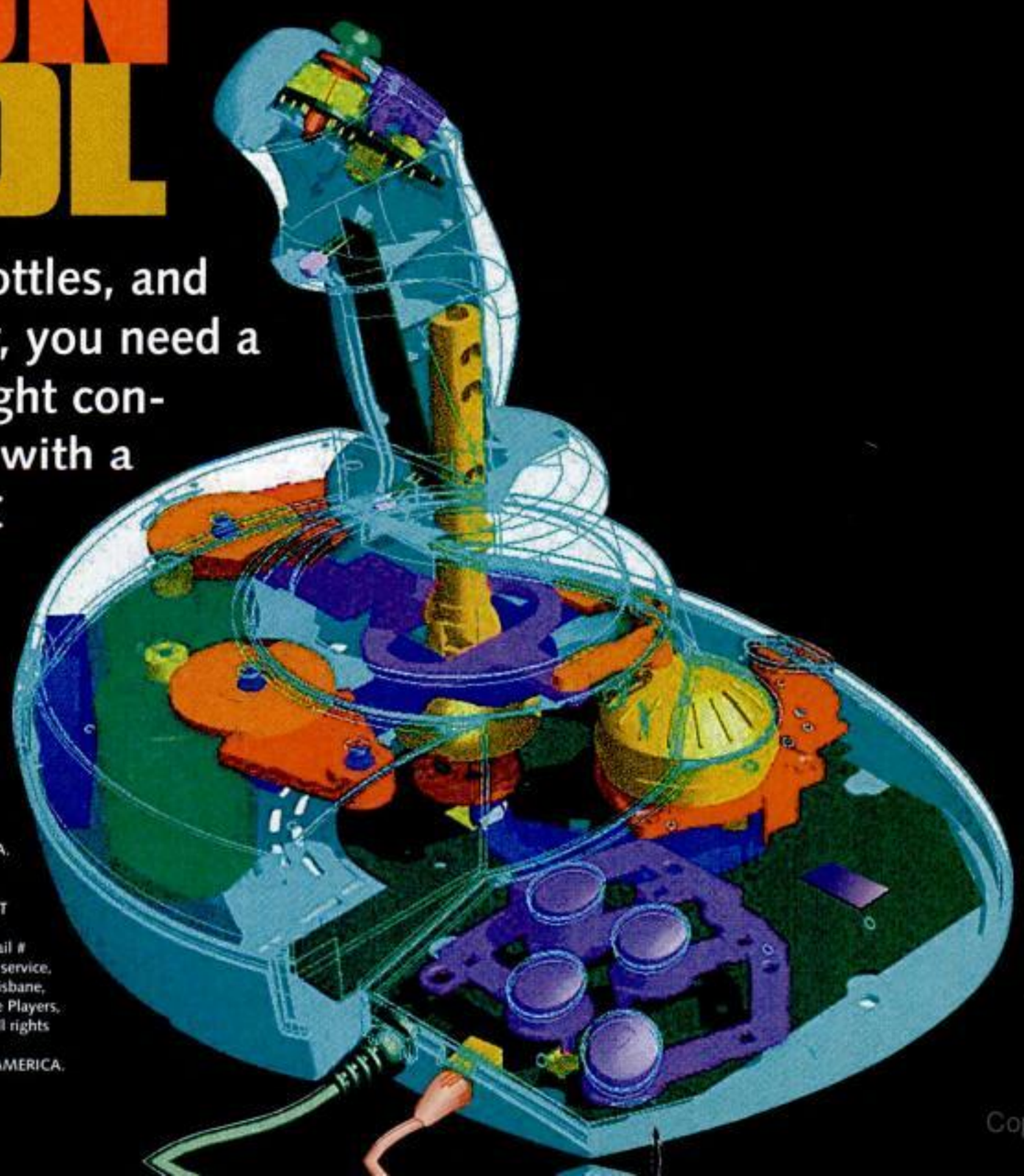
MISSION CONTROL

Gamepads, joysticks, throttles, and wheels. If you're a gamer, you need a competitive edge—the right controller to whack enemies with a vengeance. Maximum PC reviews the most radical PC game controllers you'll see on store shelves this December.



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THE SAINT

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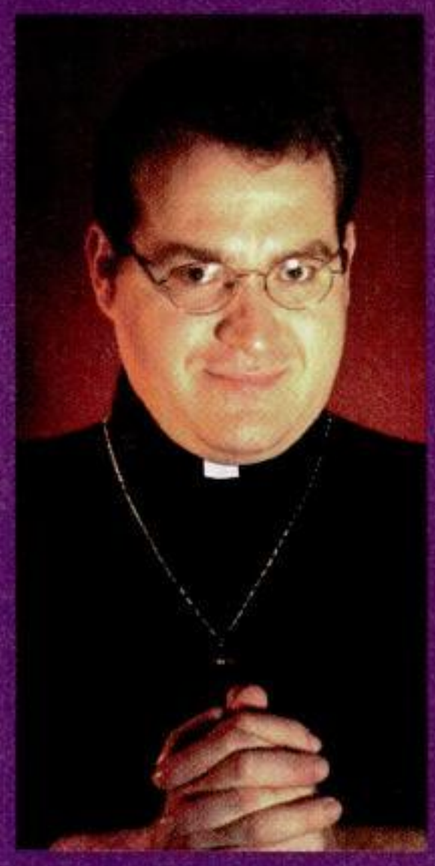

ALEX ST. JOHN
was the architect of DirectX while an evangelist at Microsoft. Since leaving the empire, he has remained a player, brokering many deals in the industry. Reach him at **saint@maximumpcmag.com**.

My Life With Hell

EVERYONE NEEDS THEIR FIRST BIG BREAK... EVEN A SAINT

Ten years ago I was hired by Hell. And no, I'm not talking about Microsoft. My first job in technology was for Hell Graphic Systems.

I was 21 and in love with computers. I had little experience, but spent most of my free time writing games on my overclocked 24MHz 386. I wore a suit to my interview with Hell and agonized for almost an hour over what tie to wear. Once the interview began, I did my best impression of what I thought they would expect of a professional demeanor, which was something like Spock with a nervous quaver in his voice. I was convinced that I needed a college degree if I ever wanted a job, but I didn't have one—or a high school diploma for that matter—and I'd never done any professional Mac, Windows, or Unix programming.

I was certain I had no chance.

In spite of my many shortcomings, and much to my astonishment, they offered me a salary of $26K a year and put me on a 90-day trial period. I was both elated and terrified. What if they discovered I had no idea what I was doing? I worked slavishly for weeks on end. I read every book I could find and picked the minds of every co-worker that would spend a minute with me.

Once, I was asked to fit a 16-hour software installation process onto just one tape. After two weeks of 18-hour days without break, I dropped two tapes on my boss's desk, and sheepishly confessed that I'd only been able to reduce the process down to 90 minutes on two tapes. It was received with an expression of bewilderment. Much later I learned that the 12 tapes I'd been handed were the best a team of engineers in Germany, where the software was originally developed, could manage. If I'd known this in advance, I'm sure I would've thought the task impossibly daunting.

A month into my new job, I was sent to a trade show in New York to learn at the hands of the guru, Dan Lorenzini. Having a corporate credit card, staying at a $200-a-night hotel, I thought it was all too good to be true. Dan assured me that the thrill of living out of a suitcase would quickly wane, but I didn't believe him.

The trade show was an important event for Hell, since each system it sold cost millions of dollars. While Dan demoed the "ScriptMaster," I was told to stay out of the way when customers were around and catch my lessons where I could. One day, a German guy I had been told was Very Important appeared on the stand with potential customers. Dan was summoned. While Dan talked to the Very Important Customers, ScriptMaster crashed. A cold chill went up my spine. Any minute now they would come over for a demonstration. I sat frozen in place for what seemed like hours not knowing what to do. Would they think it was my fault? They talked forever... maybe I could just reboot the system before they came over. I couldn't make the situation any worse, could I? I hit the reset button. "VUT ARE YOU DOINK!!!" a guy shouted in my ear. Two technicians appeared out of nowhere and started screaming at me at the top of their lungs in German. "Shhh, shhhh," I hissed, gesturing desperately for them to be quiet.

The Very Important German guy broke away from the Very Important Customers and ran over to find out what was happening. And with everybody watching, the Very Important German guy told me to get the hell off the show floor.

I went to my hotel room, crushed. My boss called later to fire me... or so I assumed, but much to my surprise he reassured me that my job was intact. He said it was probably a bad idea on his part to train me under those conditions. He said he wouldn't fire me for making a mistake unless I made the same one repeatedly, and preferred it if I learned from other people's mistakes whenever possible.

Today, I'm hiring my first nine employees. Aside from Daevid Vincent—the former webmaster of *boot* magazine—the oldest one is twenty two. The graphic designers wear suits to their interviews and do their best impression of Spock, with a touch of nervous quaver in their voices.

This is the past that someone in the future is reminiscing about.

—signboard in a London Taxi

I see their work and know that some of them are brilliant, but just don't know it yet. They don't want much money, just the opportunity to prove to somebody that they're actually capable. They work 18-hour days, they do things with the technology that I previously thought wasn't possible, and they have no idea what I'm talking about when I offer them stock options.

I'm starting to realize how Bill Gates could build an empire with people like these and wonder if 10 years from now I'll be cruising in my private jet writing *Maximum PC* columns about how naive I was when I first started my own company.

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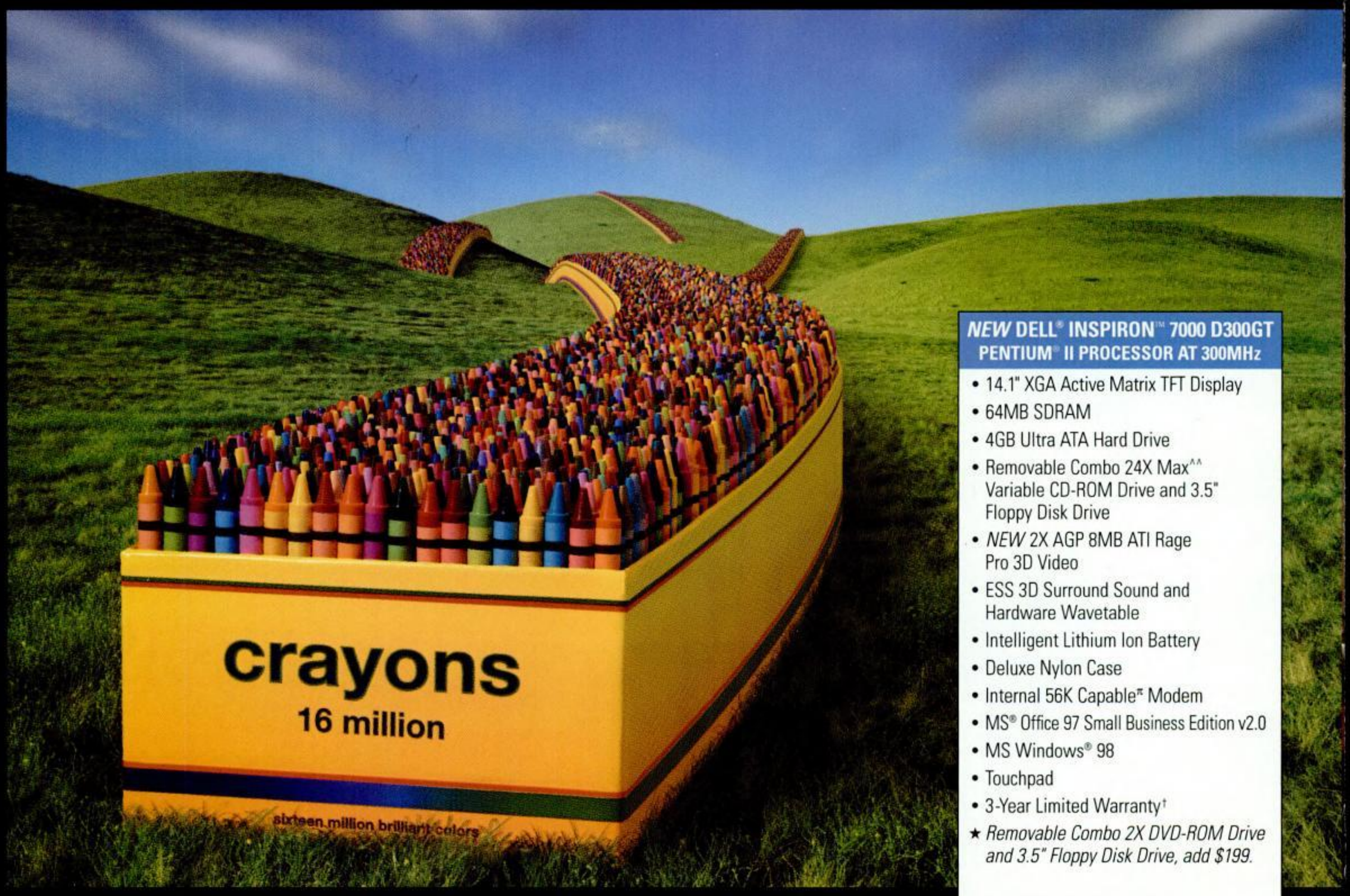

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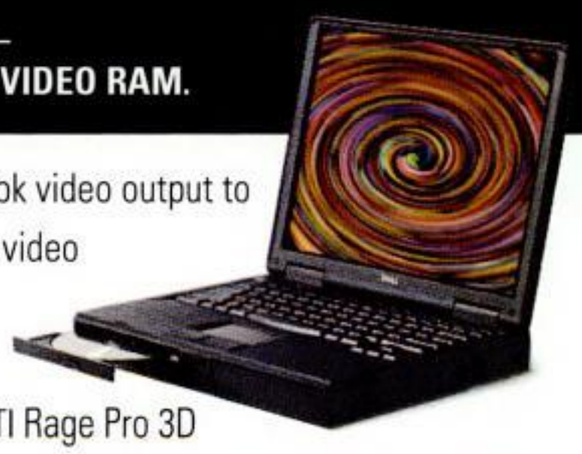

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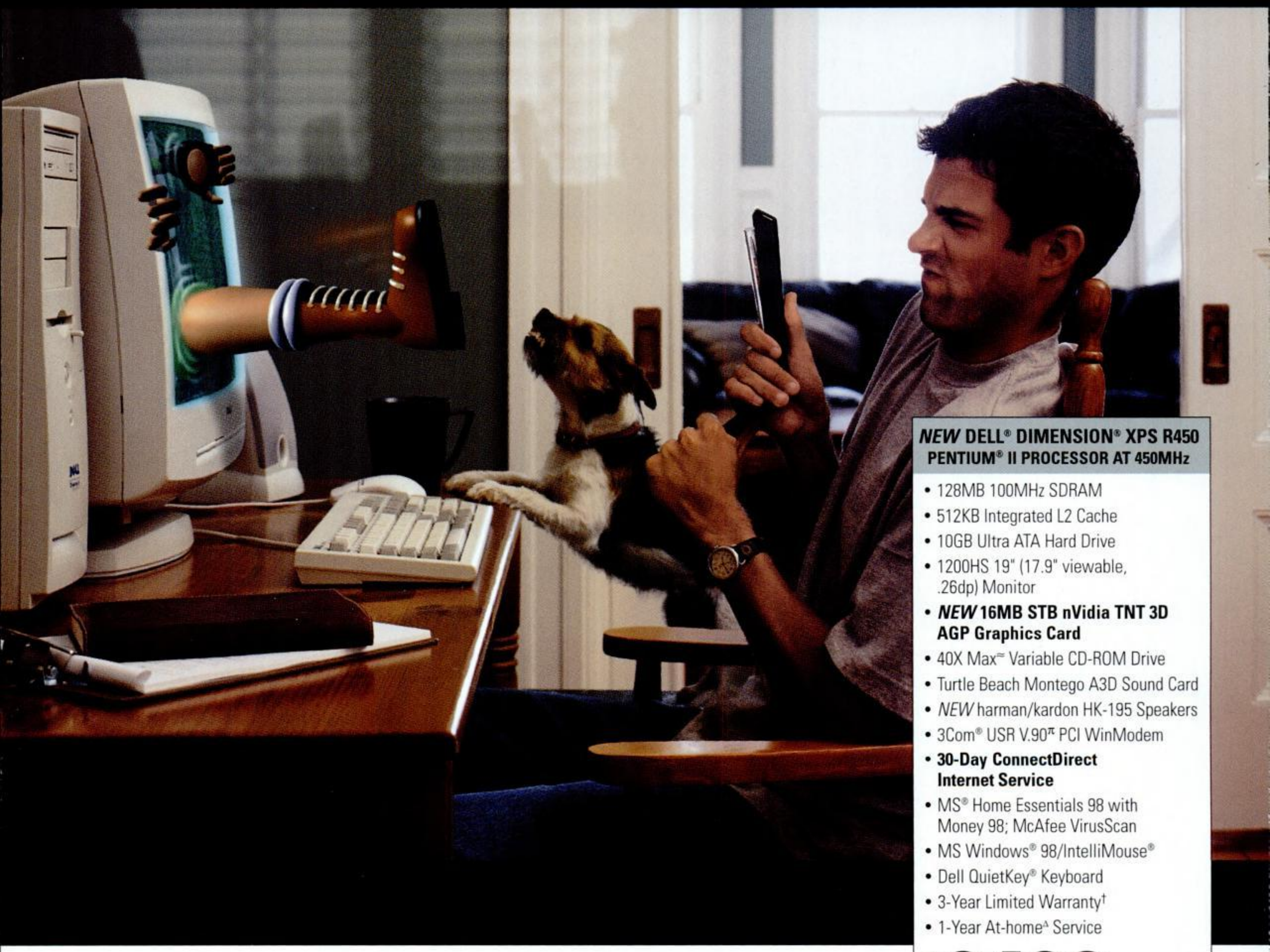

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